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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 5

RCRA FINAL DECISION  
AND RESPONSE TO COMMENTS  
SELECTION OF REMEDIAL ALTERNATIVE  
FOR GROUNDWATER

FOR

THE CHEVRON FACILITY  
near HOOVEN, OHIO

AUGUST, 2006

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## Introduction

The United States Environmental Protection Agency (U.S. EPA) presents this Resource Conservation and Recovery Act (RCRA) Final Decision and Response to Comments for Groundwater and Contaminated Soils at the Chevron facility near Hooven, Ohio. The previously released Statement of Basis for Groundwater outlined remedial alternatives possible at the facility, as well as U.S. EPA's proposed remedy. The public was notified about the public comment period on the Statement of Basis for Groundwater in the local newspapers and on the local radio station. The Statement of Basis for Groundwater (Attachment 1) was made available to the public for review and comment from April 12, 2006 to May 30, 2006. A Public Hearing was held on May 9, 2006 at the Whitewater Senior Center and Township Hall to explain the proposed remedy for groundwater and receive public comment and questions on the proposed remedy. An extension of the comment period was granted from May 30, 2006 to June 14, 2006 in response to concerned citizens requesting additional time. The comments were received by mail, fax, e-mail and in addition many of the comments on the proposed remedy came from the public hearing. U.S. EPA recorded the public hearing comments in a Transcript of Proceedings and is herein responding to the comments in writing. After considering all the comments, U.S. EPA is adding additional detail to the proposed remedy in response to the public concerns. The Final Decision presented in this document supports, but also presents additional detail and clarification, for the proposed remedy.

## Selected Remedy

The remedy will consist of the following remedial components:

- Periodic source removal of Light Non-Aqueous Phase Liquids (LNAPL) from the subsurface through a high grade pumping scheme which is anticipated to take from 6 to 12 years;
- Monitor containment of Light Non-Aqueous Phase Liquids (LNAPL) and dissolved contaminant plume. Gradually shut down hydraulic control wells and restore natural gradients;
- Contingencies: if performance measures are not met, the pumps will be turned back on, and other alternative technologies will be analyzed and chosen to remediate the plume (for example SVE, IAS, SEAR);
- Engineered controls to stabilize the bank of the Great Miami River at both the Refinery and Gulf Park, and continued monitoring of the Great Miami River

and river bank for releases;

- Monitored Natural Attenuation (MNA) of dissolved contaminant plume and LNAPL plume with associated sampling and 5 year review of the progress of the natural attenuation with the performance measure of complete aquifer restoration to below current Safe Drinking Water Act Maximum Contaminant Level (MCL) in 30 years. The 30 year time frame will begin after completion of the high grade pumping for source control which is 6 to 12 years, bringing the total timeframe to 36 to 42 years;
- Institutional controls to include prohibitions on potable groundwater use and basement construction on the refinery site;
- Point of compliance (POC) and other performance monitoring;
- Continued source removal of volatile petroleum constituent from the LNAPL smear zone beneath the town of Hooven through soil vapor extraction (SVE) during periods of high grade pumping, and whenever the groundwater level falls below the trigger levels;
- Continued monitoring of soil vapor wells in Hooven; and
- Financial Assurance for implementation of the remedy

The remedy will be designed to be protective of human health and the environment. The long-term corrective action objective is to restore groundwater to its maximum beneficial uses. U.S. EPA's goal for the 36 to 42 year time frame is to achieve the current drinking water MCLs throughout the area of contaminated groundwater. Benzene is the most widespread contaminant, and it exceeds the MCL by the greatest factor; thus it is the primary contaminant that will be used to track the cleanup of the plume. The goal for this timeframe is based on the projected attenuation pattern for benzene which involves biodegradation. Other organic contaminants, such as ethylbenzene, and 1,2-dichlorobenzene will also follow an attenuation pattern involving biodegradation. The dissolved ethylbenzene concentrations are expected to meet the current MCL in 90% of the wells at the site within 25 to 30 years after the completion of the high-grade pumping for source control. In other words, the concentration of ethylbenzene is expected to meet the MCL a little sooner than benzene. The concentration of 1,2-dichlorobenzene is expected to meet the MCL a little later than benzene. Inorganic contaminants, such as lead and arsenic, will probably follow a different attenuation pattern because they do not biodegrade. Further improvement is expected to occur very slowly. Nevertheless, at the end of the 36 to 42 year time period, the concentrations of the inorganic constituents are expected to be below the current levels, and the current levels are close to the MCLs.

After the 36 to 42 year time frame, the groundwater will still have taste and odor problems, and will still have unacceptable concentrations of other non-volatile chemicals, i.e metals. These conditions will exist for a long time. Thus, the use of the

groundwater will remain restricted and natural attenuation will continue until the groundwater quality is fully restored.

Because achieving this long-term objective will take many years, a series of interim corrective action objectives, as listed below, have been developed for the Chevron groundwater plume. These interim objectives have been designed to ensure that human health and the environment are protected until the long-term corrective action objective is achieved.

The following interim remedial objectives have been identified:

- Protect human health and the environment
- Monitor soil vapor concentrations and prevent unacceptable indoor air exposures
- Maintain plume control to prevent migration of either LNAPL or dissolved phase constituents
- Remove recoverable LNAPL to the extent practicable
- Stabilize riverbank to prevent erosion

These interim remedial objectives are interrelated and are to be achieved through the various components of the remedy.

A key component of the remedy is the containment and stabilization of the LNAPL and dissolved contaminant plumes. The LNAPL and dissolved contaminant plumes are currently contained by the ongoing interim measure consisting of the operation of a recovery well system that hydraulically controls the plumes. However, studies have indicated that the LNAPL plume may be stable under natural gradients. Consequently, operation of the site-wide recovery system may not be necessary to contain the LNAPL plume. In addition, the benzene and related petroleum compounds that emanate from the LNAPL source are generally biodegradable in groundwater. On-site monitoring has suggested that natural attenuation stabilizes the dissolved plume emanating from the LNAPL plume. Consequently, hydraulic control may not be necessary to contain the dissolved plume.

During the early phases of the remedy, hydraulic control of the plume will be gradually eased and the migration of the plumes monitored carefully to verify that the LNAPL and dissolved plumes are stable under natural groundwater gradients. The remedy includes an extensive ongoing program of monitoring both the LNAPL and dissolved plumes to verify that both plumes are stable.

For the dissolved plume, a network of monitoring wells establishes a "Containment Point of Compliance" ("POC"), beyond which the LNAPL plume or dissolved contaminants above MCLs will not be allowed to migrate. These monitoring wells are located at the approximate down-gradient boundary of the current plume, and additional wells may be added to completely monitor the down-gradient boundary (Figure 4).

Sampling of these wells will be conducted semiannually for the first five years, annually for the next five years (staggered to account for seasonality), biennially for the next ten years, and every five years thereafter. Should the performance monitoring indicate that MCLs have been exceeded at or beyond the Containment POC, operation of the extraction well system will be resumed. If necessary, Chevron will analyze and implement additional remedial measures in order to ensure containment of the dissolved plume. Alternatives evaluated and Chevron's recommended alternative will be submitted to U.S. EPA for its review and approval. Whenever new wells are installed, Chevron will develop an initial data set for the new wells by sampling quarterly for the first two years.

To ensure containment of the LNAPL plume, the ROST wells and groundwater monitoring wells outside the smear zone will be tested for the appearance of LNAPLs. These monitoring wells will be sampled semiannually for the first five years, annually for the next five years (staggered to account for seasonality), biennially for the next ten years and every five years thereafter. The contingency, if LNAPL is seen migrating, is to resume year round pumping. In addition, Chevron will analyze alternate LNAPL recovery mechanisms (including focused aggressive source removal technologies such as air sparging and solvent flushing (SEAR)) and propose a recommended alternative to U.S. EPA for its review and approval. Chevron shall implement additional remedial measures to ensure containment of the LNAPL plume.

Residual (immobile) LNAPL has been observed along the river bank. This residual has been observed to be released to the river during periods of high river flow due to bank scour and sloughing of contaminated soils along the river bank at the refinery and in Gulf Park. To eliminate such releases, the remedy may require the installation of engineered structures along contaminated portions of the bank to stabilize the bank and prevent sloughing of contaminated soil into the Great Miami River. Should this monitoring indicate that the LNAPL plume is not stable in the area adjacent to the river, special engineered barriers to LNAPL migration will be implemented along the river. The ongoing performance monitoring program will include close monitoring of the LNAPL and dissolved plumes along the Great Miami River to ensure that discharges to the river do not occur.

Since the LNAPL plume, more specifically the benzene and related volatile compounds contained in the LNAPL, are the source of contaminants in the dissolved plume, the remedy includes measures to remove as much LNAPL from the subsurface as is practical. The LNAPL recovery operations conducted to date as an interim measure have demonstrated diminishing returns. The remaining LNAPL is held in the LNAPL smear zone located above and below the water table. Most of this LNAPL is contained below the normal water table elevation and is only available for recovery during periods of low water table elevations, typically early fall to mid-winter. This scheme has been termed high grade pumping. High grade pumping involves concentrated pumping during periods of naturally occurring low water table elevation to further lower the water table in a localized area and enhance the recovery of LNAPL in that area. High grade

pumping will be operated in areas where significant quantities of potentially recoverable LNAPL are known to exist starting in the southwest corner of the facility near Hooven and the Southwest Quadrant and progressing eventually to other areas more centrally located in the facility. LNAPL recovery operations during periods of normal and high water table elevations will be suspended since recovery of reasonable amounts of LNAPL is no longer possible during these periods. At the time of the 5 year review, U.S. EPA will evaluate the high grade LNAPL recovery systems' performance to make sure that the sources of the releases have been controlled so as to reduce or eliminate, to the extent practicable, further releases of hazardous waste (including hazardous constituents) that might pose threats to human health and the environment. The high grade pumping program will continue to recover LNAPL from the subsurface until this approach is no longer capable of efficiently recovering further LNAPL.

Depletion of benzene and related volatile compounds in the LNAPL is necessary to meet the long-term corrective action goal of returning groundwater to its most beneficial use and meeting MCLs. This depletion is expected to occur through a number of processes in addition to biodegradation. Benzene is removed from the LNAPL by dissolving into groundwater passing through the smear zone. Benzene also continues to volatilize from the smear zone into the air contained in the vadose zone overlying the water table. Operation of the SVE system beneath Hooven during periods of high grade pumping, and whenever the groundwater level falls below the trigger levels; is included in the remedy to further accelerate volatilization during these periods. The recovery of LNAPL through the high grade pumping program is also intended to directly remove source material. Modeling and other analysis have resulted in predictions that these mechanisms should remove sufficient benzene and related compounds from the LNAPL to achieve the long-term performance measure of attaining current MCLs in groundwater within 42 years. In order to verify that these predictions are correct, the performance monitoring component of the remedy includes periodic investigation of the LNAPL extent and composition, combined with appropriate analysis of these data, to confirm the timely achievement of the long-term performance measure. MNA parameters should be collected and analyzed on a 5 year interval to properly gauge progress of predicted attenuation of the hydrocarbons in the subsurface, Appendix 1 contains the U.S. EPA Region 5 Framework for Natural Attenuation Decisions for Groundwater which lays out a flowchart for decision making and indicator parameters to test for in the field. Should this performance monitoring indicate that MCLs will not be achieved in a timely manner, as monitored by the 5 year reviews, additional removal of LNAPL must be implemented by Chevron. Chevron will evaluate alternatives and submit its recommended alternative to U.S. EPA for its review and approval.

The remedy includes a number of institutional and engineering controls to address any potential exposures that may occur during the interim remedial period. The institutional controls shall be established in a manner to be legally enforceable against existing and future property owners, and shall include the following use restrictions:



- 1) Land use restrictions on the facility property which are consistent with the soil cleanup standards and anticipated future land uses;
- 2) Prohibitions on construction of basements or other sub-grade areas for human occupancy on the facility, it is anticipated the facility will have industrial and recreational re-use, with no residential development, day care centers or pre-schools.
- 3) Prohibitions on potable use of ground water on the facility; and
- 4) Notice to existing and future owners of off-site properties situated above the plume emanating from the Chevron facility of restrictions on well installation contained in Ohio Revised Code Chapter 3701 – 28 (individual residential drinking water wells) and Chapter 3745-09 (public drinking water system wells.)

The restrictions in 1) through 3) above will be in the form of restrictive covenants that run with the land in conformance with the Ohio Uniform Environmental Covenants Act, Ohio Revised Code Section 5301.80 to 5301.92.

The remedial activities described in this section, including the land use controls, are designed to allow for redevelopment of the refinery property during site remediation before final remedial goals have been met. The company will have to provide an assurance that adequate financial resources are available for implementation of the remedy.

The performance measures of the remedy can be viewed in terms of the receptors potentially impacted by the LNAPL and groundwater plumes. These receptors can be grouped into the following categories based on location: 1) human receptors in Hooven, 2) human receptors in the Southwest Quadrant, 3) the Great Miami River, 4) groundwater at and beyond the POC, and 5) on-site receptors. The strategy of the remedy for protecting each of these potential receptor groups is discussed below.

**1.) Human Receptors in Hooven:** The LNAPL and dissolved groundwater plumes lie beneath a portion of Hooven. The principal potential exposure pathway to human receptors in Hooven is inhalation of constituents volatilized from the LNAPL and migrating through soil vapor to the surface. The performance measures for Hooven are (1) to ensure that the constituents from the Chevron plume will not exceed risk based residential standards in soil vapor at the ground surface (these standards are identified in U.S. EPA Office of Solid Waste and Emergency Response (OSWER) Draft Vapor Intrusion (VI) Guidance, 2002); (2) to remove as much LNAPL and associated volatile constituents from the LNAPL plume beneath Hooven, as is practical; and (3) to stabilize the LNAPL plume beneath Hooven under natural gradient conditions.

Recent investigations have demonstrated that the vapor inhalation pathway is incomplete. Benzene is more likely to present a human health risk than any other chemical in Chevron's plume of groundwater contamination due to its toxicity. However, investigation of contaminant concentrations in subsurface vapor have demonstrated that



benzene quickly attenuates through biodegradation. To ensure that this pathway does not pose any unacceptable risks in the future, the remedy includes ongoing soil vapor monitoring beneath Hooven. The vapor monitoring wells that will be tested are nested vapor wells 93, 96, 99 and 129. These wells will be sampled at 5, and 10 feet below ground surface and at 10 foot intervals to the groundwater table. These nested vapor wells will be tested twice annually during the spring and fall or to account for the high and low water table conditions for the first two years of sampling, once per year during three to five, and then every three years thereafter. If conditions permit, the samples will be collected when the water table altitude is at or below 463.5 ft-elevation for one week or longer, and before the HSVE system is operated. In addition, the SVE system installed beneath Hooven will continue to operate during periods of low water table and when the high grade pumping is performed. The operation of the SVE system at this time will serve both to capture any volatile constituents vaporizing from the smear zone and to further deplete these constituents from the upper portion of the LNAPL smear zone beneath Hooven, thus reducing the future source of benzene vapor beneath Hooven. If vapor samples show that there is a complete pathway from groundwater to the surface in concentrations exceeding the risk-based levels, Chevron shall implement measures to prevent the vapors from intruding into homes in Hooven. Such measures may include year-round groundwater pumping, operation of SVE, and/or other engineered control(s), and installing vapor vents or other engineered controls in foundations.

The high grade pumping program during periods of low water table will similarly remove LNAPL from beneath Hooven, further reducing the source of benzene and stabilizing the LNAPL plume beneath Hooven. The monitoring wells outside the smear zone will be tested to insure no new LNAPL appearance. The monitoring wells to insure LNAPL stability will be sampled semiannually for the first five years, annually for the next five years, staggered (to account for seasonality) biennially for the next ten years, and every five years thereafter. The contingency, if LNAPL is seen migrating, is to resume year-round pumping and re-evaluate alternate LNAPL recovery techniques, which may include focused aggressive source removal (e.g. air sparging, solvent flushing etc.).

**2.) Human Receptors in the Southwest Quadrant:** The LNAPL and dissolved groundwater plumes also lie beneath the western portion of the Southwest Quadrant. The principal potential exposure pathways to the human receptors in the Southwest Quadrant include the extraction and use of contaminated groundwater and inhalation of benzene through vapor migration of benzene to the ground surface. The performance standards in the southwest quadrant are to protect human receptors from exposure to contaminants in groundwater and to stabilize the LNAPL and groundwater plumes in this area. The remedy includes engineering and land use controls addressing the potential human exposures in the Southwest Quadrant. These controls include the installation of vapor barriers in buildings in these areas, and drinking water well permitting and siting restrictions imposed by the Ohio Department of Health. The high grade pumping scheme is designed to remove LNAPL from beneath portions of the Southwest Quadrant and further stabilize the LNAPL plume in this area. Monitoring of

the LNAPL in the Southwest Quadrant will be accomplished using Rapid Optical Scanning Technology (ROST) wells in three or four transects. These will be located outside the smear zone and monitored semiannually for the first five years, annually for the next five years, staggered (to account for seasonality) biennially for the next ten years, and every five years thereafter. If LNAPL is detected at these ROST wells then Chevron must resume year-round pumping until compliance is restored, and re-evaluate alternate LNAPL recovery techniques. The contingencies could include focused aggressive source removal (e.g. air sparging, solvent flushing etc.)

**3.) Great Miami River:** The performance standards for the Great Miami River are to (1) prevent any NAPL migration to the river and (2) to prevent the development of a NAPL sheen in the river. The performance standards for the Great Miami River also include (3) the prevention of any un-permitted discharge containing contaminants to the Great Miami River. While preliminary studies appear to indicate that the LNAPL plume will be stable under natural gradients in the vicinity of the river, the remedy requires engineered or hydraulic barriers to contain the LNAPL plume should performance monitoring fail to demonstrate that the LNAPL plume is stable in the area near the river. The monitoring program includes surface and groundwater monitor locations along the Great Miami River, with "early" warning components and monitoring locations at the river bank/smear zone interface. Monitoring includes, visual inspections, piezometers and monitoring wells near the river, and wells to sample pore space in river sediment. The frequency and locations of sampling are to be determined depending on river study findings. Locations known today where sampling and stabilization are needed are at the refinery and Gulf Park. Chevron is prohibited from allowing any un-permitted discharges containing contaminants to the Great Miami River. In addition, Chevron will evaluate contingency alternatives, including perimeter treatment system (e.g. sparge curtain, funnel/gate etc.), aggressive source removal (e.g. air sparging, SVE, solvent flushing (SEAR) etc.), and implement additional corrective measures if necessary to meet the performance standard of no migration of LNAPL or dissolved constituents into the Great Miami River. Chevron shall analyze alternatives and submit its recommended alternative to U.S. EPA for its review and approval.

**4.) Groundwater at and Beyond the Point of Compliance (POC):** The performance standard for the remedy in the downgradient area of the plume is to prevent the migration of LNAPL or dissolved constituents above appropriate regulatory levels (i.e., MCLs) beyond the POC. This POC will be established at the approximate boundaries of the current plume. Thus, the remedy is designed to prevent any further expansion of either the LNAPL or dissolved phase plumes. It is expected that expansion of the LNAPL plume will be prevented by the natural stabilization of the plume. The benzene and related petroleum compounds that emanate from the LNAPL source are generally biodegradable in groundwater. On-site monitoring has confirmed that natural attenuation stabilizes the dissolved plume emanating from the LNAPL plume. Consequently, it is expected that the migration of the dissolved plume will be controlled by MNA. Monitoring of the plume is key; therefore sampling will be conducted semiannually for the first five years, annually for the next five years, (staggered to

account for seasonality) biennially for the next ten years, and every five years thereafter. This performance monitoring will confirm if MCLs for groundwater will be exceeded at the six monitoring wells near the POC and no LNAPL detections in the three or four transects of ROST wells mentioned above. However, should the LNAPL plume migrate or the dissolved constituents above MCLs appear in the POC wells, Chevron will resume year-round pumping until compliance is restored. In addition, Chevron will evaluate contingency alternatives, including perimeter treatment system (e.g. sparge curtain, funnel/gate etc.), aggressive source removal (e.g. air sparging, SVE, solvent flushing etc.), and implement additional corrective measures if necessary to meet the performance standards of allowing no migration of LNAPL or dissolved constituents above MCLs beyond the POC. Chevron will evaluate alternatives and submit its recommended alternative to U.S. EPA for its review.

**5.) On-Site Receptors:** The performance standards for protecting people who will be working on-site in the future are (1) to prevent exposures to vapor constituents, (2) prevent exposure to soil containing residual contamination, and to (3) prevent groundwater use. These standards are to be met, in part, by implementing engineering controls (e.g., vapor barriers) in buildings during the redevelopment of the property. In addition, institutional controls that prevent exposure to groundwater and residual contamination in soils will be implemented in an expeditious fashion. The groundwater and land use restrictions, as stated previously, will be in the form of restrictive covenants that run with the land in conformance with the Ohio Uniform Environmental Covenants Act, Ohio Revised Code Section 5301.80 to 5301.92.

## Public Participation Activities

A public notice appeared in the Harrison Press and the Western Hills Press on April 12, 2006, and in the Cincinnati Enquirer (western zone) on April 13, 2006. The public notice was also broadcast on 89.7 FM WNKU, NPR Radio during the April 13 and 14, a.m. "drivetime;" April 15, 8 a.m. - 4 p.m.; April 17, p.m. "drivetime;" and April 18, noon to 10 p.m. Additionally, a fact sheet summarizing the statement of basis was sent to U.S. EPA's mailing list and the SB, fact sheet and online comment form were posted at [www.epa.gov/region5/sites/chevron](http://www.epa.gov/region5/sites/chevron). A public hearing was held on May 9, 2006 in the Whitewater Senior Center and Township Hall to receive comments from interested members of the public. The hearing was held from 6:30 to 10:30 pm, and approximately 70 people attended. First, EPA gave a presentation summarizing the Statement of Basis for Groundwater. The remainder of the evening was devoted to recording and verbally responding to comments and questions from the public. Additional correspondence was received after the hearing. The original comment period of April 12 to May 30, 2006 was extended to June 14, 2006 in response to concerned citizens requesting additional time and a one-week delay to some residents in receiving the fact sheet. The Statement of Basis and supporting Administrative Record were placed in the Public Library of Cincinnati Miami Township Branch 8,

N. Miami Rd. Cleves, OH 45002, and the U.S. EPA, Region 5 Waste, Pesticides and Toxics Division Records Center 77 West Jackson Boulevard, 7th Floor, Chicago, Illinois 60604-3590 for public review.

## Public Comments and U.S. EPA's Response

Many comments and questions were received orally and recorded in a transcript of the public hearing on the Statement of Basis for Groundwater. Many of the same issues were touched on in the comments and questions received by letter, fax and e-mail and EPA has summarized the questions into 68 separate subjects and written responses to these questions and comments.

### COMMENTS

1. Comment: The groundwater is contaminated, so aren't the people who live or work in Hooven drinking contaminated water?

Response: No. The residents of Hooven have been served by the Village of Cleves' municipal water supply system since the early 1950s. This is a clean supply of water from a source that is not affected by Chevron's contamination. Currently, the water supply is from a well field in the Whitewater Valley east of the Great Miami River Valley.

2. Comment: Leaks, spills, fires, explosions, and air pollution (soot) occurred while the Gulf Oil Company was operating the refinery and land farm prior to 1985. Human exposures to chemical contaminants were probably much higher in the past, before Chevron closed the refinery and began recovering petroleum contamination from the groundwater. Why doesn't U.S. EPA require an assessment of any possible past exposures?

Response: The May 13, 1993 Administrative Order on Consent (AOC) required Chevron to assess all potential sources of releases that could still pose an exposure risk. The legal authority for the AOC between U.S. EPA and Chevron comes from Section 3008(h) of the Resource Conservation and Recovery Act. This law gives U.S. EPA the authority to require Chevron to cleanup its past releases of petroleum contamination into the environment, but it does not authorize U.S. EPA to look into past exposures or to adjudicate claims for compensation from past personal injuries or harm. Compensation for harm resulting from historic exposures would be the arena of private litigation.

So, U.S. EPA's objectives for this project are to determine the nature and extent of the current contamination, and assess the potential current and future exposure pathways with the goal of selecting the appropriate construction, operation and maintenance work needed for the cleanup. We don't assess whether people were exposed to contaminants in the past, because it wouldn't change the construction, operation or maintenance work needed for the current cleanup project.

3. Comment: U.S. EPA or other agency should study the linkage between residents' health problems and site-related contaminants.

Response: Although U.S. EPA determines what health risks site contaminants might pose to nearby residents as a group, the Agency has no jurisdiction to evaluate individual health complaints or study their causes. However, the federal Agency for Toxic Substances and Disease Registry (ATSDR) and state and local health departments have some responsibility for responding to health concerns related to past exposures to hazardous chemicals. These agencies can review data on ground water, soil and air contamination and recommend to U.S. EPA actions that need to be taken to safeguard people's health. In rare instances, they can conduct health studies to determine whether individuals' health has been affected by site chemicals.

U.S. EPA's responsibility and focus has been to develop a cleanup plan that will prevent people's exposure to site contaminants now and in the future. Because of residents' concerns, however, U.S. EPA's site team has met with ATSDR and Ohio Department of Health and shared the health-related comments expressed at the meeting and in writing. This is what the Agency has learned:

- Ohio Department of Health is conducting a statistical analysis of the state's cancer registry (a database of cancer diagnoses and deaths) to determine if cancer rates in Hooven are higher than those outside the Hooven area.
- With the assistance of ATSDR, Ohio Department of Health is using recently-collected soil vapor data to revise the health consultation completed in May 2004. The report will give ODH's opinion as to whether contaminants in the ground water plume under Hooven are migrating to the surface and affecting people's health. And, it may provide U.S. EPA recommendations for further study or action to prevent people's exposure. General information about health consultations is available at:

<http://www.atsdr.cdc.gov/HAC/consult.html>.

The 2004 health consultation can be reviewed at the Cleves library and at:  
<http://www.atsdr.cdc.gov/hac/pha/FormerChevronRefinery050604-OH/FormerChevronRefineryHC050604.pdf>.

For more information about ODH's efforts, contact Robert Frey, Chief- Health Assessment Section, Ohio Department of Health, at (614) 466-1069 or [rfrey@odh.ohio.gov](mailto:rfrey@odh.ohio.gov)

4. Comment: Many residents and former refinery workers have cancer and other serious health problems and believe they are related to contamination from the Chevron facility.

Response: Many residents and former workers described cancer and other health problems at recent public meetings and in written comments. The federal laws governing the Chevron cleanup require that U.S. EPA ensure the site is properly investigated and cleaned up so that future exposures to site chemicals are prevented. The law does not authorize the Agency to study whether the site



chemicals are the cause of people's health problems. However, the Agency has studied ground water contamination extensively as well as the possible ways people can come in contact with it and reached the following conclusions:

- Ground water under the Chevron property and portions of Hooven is contaminated.
- Chevron initially began pumping out contaminated ground water in 1985 and vapors from under Hooven in 1999.
- For people to suffer health effects they must be in direct contact with pollution by breathing contaminated vapors, drinking tainted water or touching the contamination.
- Residents living in Hooven and near the site are not drinking contaminated water. The village of Cleves provides water to Hooven-area residents. This source taps ground water unaffected by the contamination and the village tests the water. To U.S. EPA's knowledge, no one is using a residential well installed into the tainted ground water plume. People are therefore not coming in direct contact with contaminated water.
- Recent ground water and soil vapor studies conducted by Chevron under U.S. EPA's direction show that contaminated vapors (the air between rock and soil particles) near the ground water plume do not reach the surface. Therefore, people are not currently coming into direct contact with contaminants in vapors.

5. Comment: There must be a current pathway for residents and workers in Hooven to be exposed to the chemical contaminants from the Chevron site.

Response: This issue was thoroughly investigated because the protection of human health is U.S. EPA's highest priority. Reports assessing the exposure and risk to the people in Hooven were submitted in the year 2000 and 2005. A human health risk assessment was submitted for the Southwest Quadrant in 2002.

It is well documented that the public drinking water supply for the village of Hooven was never affected by the contaminated groundwater from the former Chevron refinery.

We were also concerned that soot might have been released from the refinery into the air prior to 1986 and might have settled onto the soils in Hooven and remain there today. So the soils in the residential area were sampled and tested for hazardous chemicals. However, none of the samples had contaminant levels that pose unacceptable risks.

We were also concerned that the contaminants in the groundwater might evaporate into the pore spaces of the soils above the plume of groundwater contamination. We were concerned that these vapors might rise up through the soil and enter into the basements and crawlspaces of residences that have dirt floors or cracked concrete. This is the potential pathway that required the most extensive investigation. The issue was investigated in four ways. First, deep wells were constructed in the soils above the plume of groundwater contamination. These wells were designed to allow sampling of the soil gas at several different levels below the ground surface. As expected, the highest concentrations of contaminants were found in the soil gas just above the groundwater table. However, the vapors do not extend all the way up to the ground surface. Instead, soil gas samples taken about



half way between the groundwater table and the ground surface had only trace amounts of contamination.

Second, the soil gas samples from these wells were tested for evidence of biological decomposition. The results indicated that the bacteria in the soil break down the vapors as they rise upwards through the soil. The oxygen and carbon dioxide readings from the gas samples confirm the bacteria breakdown. This explains the reason why the vapors dissipate about halfway between the groundwater table and the ground surface.

Third, shallow wells were constructed near a good number of the residences in Hooven. Soil gas samples were taken from these wells and through small holes drilled through the basement floors. Except for a few residences that have already been contacted, the soil gas samples taken were found to have no substantial concentrations of any contaminants. The concentrations in the soil gas near the homes that are directly above Chevron's plume of groundwater contamination were about the same as the concentrations in the soil gas near the homes that are not directly above the plume.

And fourth, although the soil gas near a few of the homes was found to have vapor concentrations that might pose unacceptable risks if they can enter the homes through the basements or crawlspaces, the chemical contaminants near these homes are not the same chemical contaminants that are in Chevron's plume of groundwater contamination.

One chemical that is not present in Chevron's plume is chloroform. It is possible that chlorinated wastewater might interact with organic matter in the septic tanks and release chloroform into the soil gas through the leaching fields. In any case, since chloroform did not originate from the former Chevron refinery site, Chevron has no responsibility to investigate this matter any further.

Based on this thorough investigation, the U.S. EPA has determined that currently there are no exposure pathways from Chevron's contamination to the community residents, and that Chevron's contamination does not pose any current human health risks to the residents or workers in the community.

It is possible that some of the health problems seen in this community might be related to exposures from the past operations when the facility was active prior to 1986. However, the U.S. EPA did not evaluate the health risks due to from past exposures for the reasons described in our response to Issue # 2.

6. Comment: If some Hooven residents are still concerned about soil vapors, how can they seal their basements better? Would the basements have to be filled with concrete?

Response: After receiving soil vapor sampling results we sent letters to owners and renters of homes that had soil gas contaminant levels that were above U.S. EPA's guidelines. No samples of indoor air were collected. The soil gas outside the homes was sampled, and the potential for contamination of indoor air was estimated. The residents were advised about the possibility that contaminated soil

gas might enter their homes. We recommended that those owners consider the idea of reducing the potential for vapors to enter their homes, and we described some ways that this could be done, including sealing cracks and filling in crawl space area with a barrier material which may include flowable concrete. Our intent was to start a conversation about the sampling results and the possible improvements that could be made to the homes. U.S. EPA's pamphlet entitled "Consumer's guide to Radon Protection: How to Fix Your Home" is a helpful guide to preventing soil gas from entering a home. The pamphlet is available on-line at <http://www.epa.gov/radon/images/consguid.pdf>.

(Note: the pamphlet discusses radon gas, which is a naturally-occurring soil gas that has nothing to do with Chevron's contamination. However, the techniques described in the pamphlet would work to prevent any kind of vapor barrier from entering a basement or crawl space. Also note that an inexpensive radon test kit will not test for volatile organic compounds, which are the contaminants of concern in Hooven.)

7. Comment: The remediation time frame of 30 years or longer is unacceptable because people who live or work in Hooven are currently being exposed to chemical contaminants from the Chevron site. The unacceptable exposures should be stopped immediately. U.S. EPA should get Chevron (or some government agency) to purchase the homes that have unacceptable exposure and demolish them.

Response: Protecting the health of people in the Hooven area from the environmental contamination from the former Chevron refinery is our highest priority.

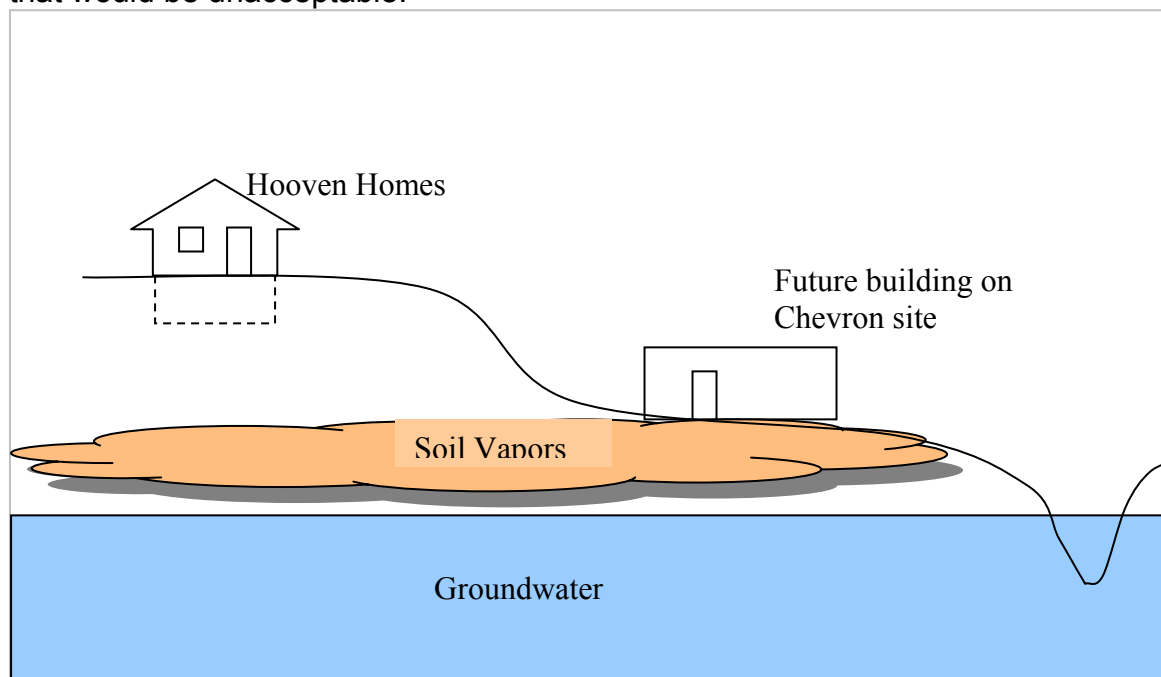
If we believed that Hooven residents were currently being exposed to hazardous chemicals, then we would have required Chevron to stop those exposures immediately. Based on sampling of soil, groundwater and the vapors in the pore space of the soil, an analysis of all potential exposures pathways has been conducted. We believe that no one is being exposed to unacceptable levels of the chemical contaminants from the former Chevron refinery. It is especially important to note that all of the residents of Hooven are served by a safe public drinking water system, and that the vapors in the soils above the contaminated groundwater degrade before reaching the ground surface. Thus, the vapors from Chevron's contaminated groundwater are not intruding into the residences, and are not causing the indoor air to be unsafe.

It is impossible to clean up the groundwater immediately. All of the cleanup alternatives would take many years to restore the groundwater to a usable condition. But as long as no one is being exposed to unsafe levels of hazardous chemicals, it would not be unreasonable to select a remedy with a long cleanup time frame.

8. Comment: New buildings to be constructed on the former refinery site will not be allowed to have basements because that might result in unacceptable human exposures to vapors rising from the contaminated groundwater. So, how can U.S. EPA say that the residential basements in Hooven are safe?

Response: The residences in Hooven are located up the hill from the former Chevron Refinery. The ground surface at the former refinery site is generally about 20 to 55 feet lower than the ground surface where the residences are located. The ground water surface is also higher under the residences than under the former refinery site, but only a few feet higher. So, if a basement were to be constructed

on the former Chevron refinery site, it might extend down into the soil vapors, and that would be unacceptable.



9. Comment: Does the rising and falling of the groundwater level make any difference in the potential for vapors to intrude into homes? Soil vapor testing should be done in the springtime when the groundwater level is highest.

Response: When the ground water level is high in the springtime, the top of the groundwater is closer to the bottoms of the basements and crawlspaces. The contaminants are dissolved in the groundwater and are less likely to evaporate into the pores between the soil particles above the groundwater. When the groundwater level is low in the late summer/early fall, there is obviously more space between the groundwater and the basements. However, the contaminants have a tendency to accumulate in a layer on top of the groundwater (LNAPL). This makes it easier for the volatile contaminants to evaporate into the pores of the soil above the groundwater. In addition, more of the "smear zone" is exposed, which also makes it easier for the contaminants to evaporate.

Tests of soil vapors below and next to Hooven homes, and at varying depths within the soil profile and aquifer have demonstrated that the vapors have not risen to the level of the basements. However, as a precautionary measure, U.S. EPA will require Chevron to sample the nested vapor wells twice annually for the first two years of the final remedy's sampling period, once in the spring (high water table) and once in the fall (low water table).

10. Comment: Which homes are safe to live in? Which homes are safe to visit?

Response: With regard to Chevron's contamination, it should be clearly understood that all of the homes in Hooven are safe to live in and to visit.

As described in our response to Comment #6, during the course of the thorough investigation into Chevron's contamination, a few homes were found to have unusual situations that are not related to Chevron's contamination. We felt an

obligation to tell the owners and residents of these homes about the results of the soil vapor sampling, and they have all been notified. None of these homes are unsafe in the short-term. If the soil vapors situation around these homes persists for many years into the future, the risk to the residents would still be relatively low, due to the limited frequency of exposure to vapors that might be present in the basement.

11. Soot was deposited on the soil of residences in Hooven while the refinery was in operation. Has the soil been tested for the chemical contaminants in soot? Is it safe to eat the vegetables that the residents grow in their home gardens? Is it safe for children to play in the yards? Is it safe for children to come in direct contact with dirt and mud?

Response: Soil testing has been conducted in portions of Hooven, in proximity to residences, in association with Hooven Sewer Line Risk Assessment from July 2004. The soil testing was over various locations in Hooven and analyzed for metals, Volatile Organic Compounds (VOCs) and Semivolatile Organic Compounds (SVOCs). Samples taken near the surface (at 0.5 foot to 3 foot) and at depth (7 to 10 feet below the surface) revealed no detections of VOCs or SVOCs in those samples. Metals analysis, taken at those same depths revealed results within acceptable EPA risk limits, with only arsenic exceeding those limits. The level of arsenic found in Hooven is typical of the arsenic that occurs naturally in the soils in this part of Ohio. Analysis was conducted for the risk associated with touching (dermal) exposure and breathing (inhalation) exposure from the soil samples taken in the Hooven Sewer Line Risk Assessment. The risk from exposure to soils and vapors to construction workers – who have more contact with soils than the residents - is minimal. The risk to residents would be much less.

12. Comment: We don't trust Chevron. Is U.S. EPA basing its proposed remedy for the Chevron site in Hooven entirely on data collected by Chevron? Are U.S. EPA representatives on-site whenever samples are taken? How often do U.S. EPA representatives visit the site? Has U.S. EPA ever analyzed any samples from the Chevron project in U.S. EPA's own laboratory? If so, have the results been compared with the sample analysis results from Chevron's laboratory?

Response: U.S. EPA representatives have visited the former Chevron facility many times since the consent agreement was signed in 1993, and are quite familiar with the site. The consent agreement required Chevron to submit many workplans and reports, and U.S. EPA representatives have read and reviewed all of these workplans and reports. Chevron was required to submit sampling plans and quality assurance project plans to U.S. EPA prior to initiating the sampling. U.S. EPA project team carefully reviewed the proposed sampling locations, as well as the procedures for taking the samples and making sure that they are properly delivered to the laboratory. The U.S. EPA project team also reviews the laboratory test methods and operating procedures to make sure that the laboratory can get reliable results. U.S. EPA representatives have also observed some of Chevron's sampling events to verify that the approved workplans were being followed. Prior to the May 9 public hearing, the U.S. EPA had collected split samples with Chevron on site on at least three occasions in various media and sent them to our own laboratory for analysis. Splitting samples means that a sample is taken and divided into two parts.

Each of the two parts is sent to a different laboratory. We then compared the results from our laboratory with the results from Chevron's laboratory and found them to be about the same.

While unsettling to some, U.S. EPA representatives do not observe all of the sampling events at all of the cleanup projects that we oversee. Most environmental laws are based on the concept that the "polluter pays." Thus the responsible company must conduct and pay for the investigation and cleanup. The appropriate level of U.S. EPA oversight and direction depends on the circumstances in each different situation. The U.S. EPA can bring both civil and criminal charges against any individual or company if found to have falsified any sampling results. It is also important to note that Chevron has found extensive contamination in the groundwater and in the soils at the former refinery site while following the U.S. EPA-approved sampling plans.

In response to the comments that we received on this issue, U.S. EPA and Ohio EPA representatives collected split samples during the week of June 26, 2006. U.S. EPA split soil vapor samples with Chevron, and Ohio EPA split groundwater samples from the former land farm area. In addition, U.S. EPA took split samples of soils from a portion of the former refinery site where the soil removal had recently been conducted.

The groundwater and soil sampling were regularly scheduled events, but the soil gas sampling was not. U.S. EPA asked Chevron to schedule a sampling event for the soil gas wells located in Hooven public rights-of-way, and Chevron agreed. The final laboratory reports from the two laboratories have not yet been received, but the preliminary results from the U.S. EPA laboratory confirm the existence of a layer of clean soil gas about half way between the groundwater and the ground surface. We plan to issue another newsletter later this year to explain the final laboratory reports.

13. Comment: Is U.S. EPA willing take samples from Chevron's soil vapor wells and then give those samples to a local community group for analysis at a laboratory that it selects?

Response: We addressed the issue by splitting samples with Chevron as described above. If we had given samples to a community group, and if its laboratory results were substantially different from those reported by Chevron's laboratory, then U.S. EPA would have had to take additional split samples to determine which of the two laboratories produced the incorrect results. So, we went ahead and analyzed split samples in our own laboratory. The laboratory results will be explained in a fact sheet to be issued later this year.

14. Comment: Does the excavation phase of local construction projects, such as installing new sewers, allow the soil vapors above the plume of groundwater contamination to be released to the air?

Response: No. Typical excavation projects are generally not deep enough to be affected by the vapors from Chevron's groundwater contamination. A specific study of any health risks associated with the sewer construction has already been



conducted. Samples of soils and vapor well samples were collected in 2004, and a report entitled *Hooven Sewer Line Risk Assessment* was prepared. The analysis concluded that the risk of construction workers breathing Volatile Organic Compounds (VOCs) while working in a trench was very low. Of course, any persons who may be nearby during construction would have even lower risks of exposure to VOCs, because they would be farther away from the trench.

15. Comment: Why did Chevron mention vapor sampling results from New York in Chevron's report on the vapor intrusion issue in Hooven?

Response: This question refers to the study conducted by the New York State Department of Health (NYSDOH). Between 1997 and 2003, the NYSDOH undertook a study of the occurrence of volatile organic chemicals (VOCs) in the indoor air of homes that heat with fuel oil. The purpose of the study was to characterize the indoor air environment of fuel oil heated homes not affected by a fuel spill to compare with homes that have been affected by fuel oil spills. The study included basement, living space and outdoor samples from 104 homes, tested during both heating and non-heating seasons. The intent of referencing this study in the Hooven investigation was to provide some information on the background levels of volatile organic chemicals in indoor air of the homes heated with fuel oil. This information was provided as supporting evidence and did not influence in any way the conclusion that there is no exposure pathway from vapors coming from contaminated groundwater.

16. Comment: If the people who live or work in Hooven aren't being exposed to chemical contaminants from the Chevron site, then why is U.S. EPA proposing any cleanup at all?

Response: The U.S. EPA is tasked with protecting human health and the environment, including the groundwater. Accordingly, our long-term goal is to restore the groundwater so that it can be used. Also, while studies have shown that there is currently no exposure pathway to the people of Hooven, the plume of contamination needs to be monitored closely to make sure that an exposure pathway does not develop in the future. The cleanup remedy calls for periodic monitoring of the soil gas and groundwater to assess the status of the cleanup and ensure human health is not adversely affected. It also calls for monitoring to make sure that the plume of contamination will not migrate beyond its current boundaries.

17. Comment: Is the school safe? Is the school yard safe for children to play?

Response: Yes, the school is safe and the schoolyard is safe for children to play. A site risk assessment was conducted for the school by Chevron and its consultants at the request of the elementary school principal. U.S. EPA reviewed this risk assessment. Risk analysis showed that the school indoor air environment is safe for the kids, teachers, and the caretaker. Since the soil gas is considerably diluted in the outdoor air when compared to indoor air, the school yard is safe and the concentrations will be even lower than in the indoor air.

18. Comment: Is the Great Miami River safe for swimming and other recreational uses?



Response: Yes. Sampling of the surface water of the Great Miami River in the summer of 2005 has shown sample results that meet the Ohio EPA surface water quality standards.

19. Comment: Is it safe for children to come in direct contact with surface water and sediments while playing in the creek north of the former refinery site?

Response: The creek north of the refinery is upgradient of the regional groundwater flow in the area. Therefore, the contamination from the refinery does not flow towards the creek or the area to the north of the refinery. Data collected in the north end of the refinery since the Order was in place shows the plume within the refinery boundary. This data leads to the conclusion that the groundwater contamination from the refinery has not impacted that area.

20. Comment: Have the deer, birds, fish and other wildlife been tested for contamination?

Response: An ecological risk assessment was conducted for the Chevron Site in November, 2000 and it was reviewed and approved by U.S. EPA. The risk assessment considered birds (American robin, marsh wren, and red winged blackbird), fish, and other wildlife including fox squirrel, eastern cottontail, woodchuck, and raccoon. The risk assessment found little risk to wildlife, except in the area of the Solid Waste Management Units (SWMUs), and this is one of the reasons that these SWMUs are being excavated as part of the 2004 soils remedy. A specific report was requested for analysis of the deer population during the August 2003 public hearing on the soils remedy. In response to the comments, U.S. EPA asked Chevron to study this issue. Chevron submitted the report *Cincinnati Facility Deer Ingestion Pathway: Risk Analysis* in January 2005. The report studied the risk of eating venison from deer harvested near the Chevron site by hunters. The deer are assumed to eat the vegetation on the Chevron facility as a large portion of their diet. The report concludes that no unacceptable risks to human health are associated with consumption of the deer.

21. Comment: Is the corn being grown on local farms safe?

Response: U.S. EPA is not aware of any threat to corn crops in the area.

22. Comment: Is the water in Cleves safe to drink? Has U.S. EPA determined whether the plume of contaminated groundwater from the former refinery extends under Cleves? Why did Chevron contribute money to the relocation of the Cleves water supply wells to Kilby Road?

Response: Currently, the water in Cleves is supplied by the Cleves Waterworks. Its supply wells are located in the Whitewater Valley west of the Chevron facility. The previous water supply wells for Cleves were located east of the Great Miami River and north of route 50. A plume of contamination was present in an adjacent area on an island in the Great Miami River, due to pipeline leaks. There were a series of monitoring wells between the island plume and the Cleves water supply wells. These early warning monitoring wells were sampled every two weeks from 1995 to May, 2001 and no impact from the plume was ever seen in these wells. U.S. EPA

was not involved in any transactions between Cleves and Chevron regarding relocation of the water supply wells.

23. Comment: In July of 2005, seepage was observed in Gulf Park. Is that seepage related to the groundwater contamination originating from the former refinery site?

Response: On July 13, 2005 small releases called “spotting” were observed near Gulf Park. Monitoring of this site began immediately, including surface water sampling. While the surface water results indicated all results were within Ohio EPA surface water quality standards, the oil spots were seen near some contaminated soil on the shore. Chevron’s pipelines run from the refinery through the islands and Gulf Park to a terminal on the Ohio River. The source of this contamination was a Chevron pipeline leak in Gulf Park. This contamination is separate from the main plume at the refinery. These releases were initially observed sporadically and subsequent visual monitoring of the river has shown no continuation of these releases.

24. Comment: Some commenters expressed a preference for Alternatives 3, 4, or 5 because those alternatives seem more active and would clean up the environment quicker. Similarly, others commented that the remediation time frame should be no longer than 15 years.

Response: It is technologically impossible to clean up the groundwater immediately. All of the cleanup alternatives would take many years to restore the groundwater to a usable condition. Alternatives 3, 4, and 5 call for equipment to operate for 12, 10, and 8 years respectively, and monitored natural attenuation would begin after that time. As long as no one is being exposed to unsafe levels of hazardous chemicals, it would not be unreasonable to select a remedy with a long cleanup time frame.

25. Comment: Some commenters said that Hooven is a low income area, and suggested that U.S. EPA would select a remedy with a shorter cleanup time frame if the former refinery site had been located in a more affluent area.

Response: The U.S. EPA policy states “a preference for expeditious stabilization of the releases, followed by timely completion of corrective action and full restoration of contaminated media; however, a number of factors may influence the time frame within which the cleanup standards can be attained, including: the extent and nature of the contamination from the facility; risks to human health and the environment before and during the remedy implementation; practical capabilities of the remediation technologies; the availability of treatment and disposal options; and the desirability of utilizing emerging technologies.” The income level of the community is not a factor in selecting the appropriate remediation time frame.

26. Comment: How did U.S. EPA consider cost-effectiveness when it proposed Alternative 2? Shouldn’t the health care costs resulting from unacceptable exposures to contaminants have been factored into the analysis of costs?

Response: We considered five alternative remedies in our April 9, 2006, Statement of Basis for Groundwater. Cost was not the only factor in our decision to propose Alternative 2 as the remedy for the Chevron site. Four alternatives met our most important requirements. Our guidelines call them our four “threshold criteria:” to

provide adequate protection of human health or the environment, to provide adequate control of the source of the contamination, and to meet applicable standards. One alternative (no further action) did not meet our threshold requirements, so it was eliminated from further consideration. We then used five additional criteria to compare the four alternatives that did pass. Our guidelines call them our five “balancing criteria:” (1) Long-term reliability; (2) Reduction of toxicity, mobility or volume of wastes; (3) Short-term effectiveness; (4) Implementability; and (5) Cost. The cost considered is based on the total estimated cost of construction and maintenance of the remedy over its lifetime.

We want to make it clear that that protecting your health and the health of others in the Hooven area is our highest priority. If we believed that Hooven residents were currently being exposed to hazardous chemicals, then we would have required Chevron to stop those exposures immediately. Based on sampling of soil, groundwater and the vapors in the pore space of the soil, an analysis of all potential exposures pathways has been conducted. We believe that no one is being exposed to unacceptable levels of the chemical contaminants from the former Chevron refinery. It is especially important to note that all of the residents of Hooven are served by a safe public drinking water system, and that the vapors in the soils above the contaminated groundwater dissipate before reaching the ground surface. Thus, the vapors from Chevron’s contaminated groundwater are not intruding into the residences, and are not causing the indoor air to be unsafe.

27. Comment: What’s the purpose of the 5-year review?

Response: The purpose of the five year review in the cleanup plan is to assess the progress of the remedy component. For example, if the groundwater monitoring results indicate that contamination is not naturally degrading at the rate anticipated, then other possible remedies need to be considered. In addition, if contamination is detected in the “point of compliance” monitoring wells at the edge of the plume, then the pumps should be turned back on, and other remedy choices would need to be assessed.

28. Comment: Will the high grade pumping cause soil erosion below ground? In Florida, the pumping of groundwater sometimes causes sinkholes to develop.

Response: The geology of Florida region and the Hooven area are very different. The Hooven Area is a glacially carved valley filled in with glacial outwash material, primarily sands and gravel. The Florida region has bedrock made of limestone. Limestone can dissolve in groundwater easily, forming caverns within the rock. When the roof of the cavern reaches the surface and collapses a sink hole is formed. The sands and gravel deposits in the Hooven area do not form sinkholes when water is pumped out of them.

29. Comment: Where does Chevron send the petroleum products that they recover from the groundwater? Where do they send the contaminated soil that they excavate?

Response: The petroleum pumped out of the ground comes in two types; groundwater that contains a very small amount of dissolved constituents, and more concentrated petroleum known as Light Non-Aqueous Phase Liquid or (LNAPL).

The dissolved phase petroleum is treated on site in a treatment plant on the Chevron site with a constructed treatment wetland as the final treatment. The LNAPL recovered is sold as to cement kiln for use as a low grade fuel. The soils that are excavated are sent to several different places depending on whether they are classified as hazardous wastes or solid wastes according to the regulations. The hazardous soils are sent to a hazardous waste landfill in Roachdale, Indiana. The non-hazardous soils are sent to the Stony Hollow facility in Dayton, Ohio and previously the Cherokee Run landfill located in Bellefontaine, Ohio.

30. Comment: Why do trucks park near a little gate on the left side of Cilley Road as they make their way up the hill from Route 128? Are they dumping contaminated soil somewhere in that area?

Response: During the week of June 24, representatives of the U.S. EPA and Ohio EPA visited the land farm and looked for any evidence of dumping. (Trucks transporting contaminated soils from the former refinery site are not supposed to take that route or dump anything there.) If any dumping had occurred within the past few months, the vegetation would have been disturbed. We found that the vegetation mature at about five feet high and had not been disturbed.

31. Comment: There's no air monitoring at the Chevron site.

Response: The site has 3 air monitoring stations that were installed as part of the soils cleanup. The station area located upwind, downwind, and between Hooven and the soil excavations. Monitoring for particulates are accordance with the National Ambient Air Quality Standards (NAAQS), and operates seven days a week and uses a 24 averaging time sample. Air toxic samples Volatile Organic Compounds (VOCs) are taken week days when excavation is taking place, an upwind and downwind sample. Air sampling for metals are taken twice a week using a high volume sampler.

32. Comment: After the groundwater cleanup is completed, what can the groundwater be used for?

Response: The contaminated groundwater cannot be used in the near future, but U.S. EPA's long-term goal is to restore the groundwater so that it can be used as drinking water.

33. Comment: It might be difficult to sell my property right now, due to the concern about unacceptable health risks. I might get less money for my property than for a comparable property located elsewhere, away from the Chevron site. Will anyone reimburse me for my loss?

Response: If anyone involved in property transactions (owner, realtor, banker, mortgage broker, underwriter, prospective buyer) wants to know the current situation in regards to human health risk in Hooven please have them contact the U.S. EPA project manager, Christopher Black, at (312) 886-1451. If you prefer, you can contact him by e-mail at [black.christopher@epa.gov](mailto:black.christopher@epa.gov). The U.S. EPA cannot reimburse homeowners for property devaluation.

34. Comment: Which map shows the locations of the wells that Chevron has abandoned?

Response: The monitoring network for contaminated groundwater is summarized in the *Semi Annual Groundwater Monitoring Report*. The report shows the current monitoring well locations, a review of the past *Semi Annual Groundwater Monitoring Reports* would reveal any particular well that is no longer in use or abandoned. U.S. EPA is not currently aware of a single map that shows all abandoned wells. Certain monitoring wells have been abandoned due to age, condition problems, or redundancy and have been abandoned with U.S. EPA approval.

35. Comment: In the past, vapors must have been present in the air above ground in the creek area because bad odors occurred frequently and a fire broke out in 1980.

Response: The creek referred to, I assume, is the creek that flows towards the Great Miami River north of the facility. This area is upgradient of groundwater flow as explained in question # 19. U.S. EPA does not anticipate any impact from the contamination on site to this creek north of the facility, be it groundwater or vapor impact.

36. Comment: Thirty or forty years ago, the groundwater contaminant plumes at the former refinery property, Gulf Park, Cleves Commercial Park might have been connected to form one big plume.

Response: The plume that originates on the Chevron property and is present under Hooven and the southwest quadrant is separate from the plumes at Gulf Park and on the island in the Great Miami River. The plumes at Gulf Park and on the island in the Great Miami River are from Chevron's pipeline releases. The plume that originates on the Chevron property is from primarily from releases from the storage of refined product at the site. The current borders of these plumes have been defined and they have been differentiated as distinct plumes.

37. What happened to the asbestos pipe insulation when the refinery was demolished? It appears that no effort was made to prevent human exposures to asbestos dust during the demolition.

Response: The demolition of the refinery was conducted by Chevron and they are subject to the Clean Air Act - National Emissions Standards for Hazardous Air Pollutants (NESHAP) standards. The Asbestos NESHAP requires facility owners and/or operators involved in demolition and renovation activities to control emissions of particulate asbestos to the outside air. Chevron is responsible to remain in compliance with these regulations during the demolition activities.

38. Comment: People who worked at the refinery have said that there were leaky valves and piping associated with Pump Well #3 and Pump Well #7.

Response: In the Spring of 2004 pump wells # 4 and #5 were undergoing maintenance due to failing components in the well. At times, the refurbishing of wells involves using an acidic solution to clean out calcification or iron rich buildup. When this process takes place, personnel involved wear personal protective equipment, such as tyvec suits, to keep the acidic solution off of them. These wells



at the north end of the Chevron facility are currently in use mainly to provide clean water to the granulated active carbon unit, which is a part of the water treatment plant on site.

39. Comment: In the past, cattle and vegetables were raised on land leased from Gulf Oil Company. Was that food safe to eat?

Response: U.S. EPA can only assume where the land was that was leased to Gulf Oil. We assume it was the ridge top area, west of Rte. 128. U.S. EPA's May 1993 Administrative Order on Consent, included among other tasks, identifying the Solid Waste Management Areas (SWMUs), the Areas of Concern (AOCs) and identifying the nature and extent of the groundwater plume. In this process studies were done on the facility and off site properties. U.S. EPA is not aware of impacts on any lands used for agricultural purposes. The location of the leased lands mentioned in the question and when these lands were used for agriculture is not identified; therefore comparing these locations and time of use to the environmental data available could not be conducted in response to your comment.

40. Comment: How many cleanup projects does Chevron have in Region 5? How many cleanup projects does U.S. EPA oversee in Region 5?

Response: Chevron is also cleaning up a former Texaco refinery in Lockport Illinois under the RCRA corrective action program. The U.S. EPA is currently overseeing about 178 RCRA corrective action projects in Region 5 (Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin). Some are still investigating the contamination and other sites have already been cleaned up. This list includes a variety of industrial facilities, such as steel mills, oil refineries, chemical plants, metal finishers, smelters, and automobile factories. Chevron's Lockport, Illinois project is one of at least 221 additional RCRA cleanup projects that the six state agencies within Region 5 are overseeing.

41. Comment: There should have been more public involvement from 1993 to 2003.

The 1993 legal agreement between Chevron and U.S. EPA required Chevron to do public outreach. Chevron established the Chevron Community Advisory Panel (CAP) and held its first meeting in 1995. Nearly 100 public meetings of the CAP have been held. Over the years, Chevron has given the residents the opportunity to sit on the panel, and all meetings have been open to the public. U.S. EPA has fulfilled its guidelines for public involvement, including holding public comment periods on its proposed cleanup plans (Statements of Basis) and holding public hearings and meetings. In the past few years, it has also mailed fact sheets to residents of the area. Chevron has also issued its own fact sheets.

42. Comment: Why did some people experience a delay in receiving U.S. EPA's Fact Sheet?

Response: A U.S. EPA representative made an error in addressing a box of newsletters for shipment, causing a delay of about one week. We apologize for this error. Please note that we extended the comment period by about two weeks from



May 30 to June 14.

43. Comment: Some commenters think another public meeting should be held so that we can get a better understanding of the situation.

Response: We have already mailed fact sheets summarizing the cleanup proposal to area residents and made the Statement of Basis available on our web page, the Cleves library and other places near Hooven. We also held a public hearing with a presentation, followed by questions and answers and an opportunity to comment. At this point, the best way for residents to get to get a clearer understanding of our proposed remedy is to contact U.S. EPA's project manager, Christopher Black, at (312) 886-1451 and ask him questions directly. If you prefer, you can contact him by e-mail at [black.christopher@epa.gov](mailto:black.christopher@epa.gov). At this point, another public meeting wouldn't be as effective as a one-on-one conversation.

44. Comment: Nothing has been accomplished since 1985.

Response: A lot has been accomplished. Here are some of the highlights:

- Potential human health exposure pathways have been thoroughly investigated, and the U.S. EPA has determined that no one is currently being exposed to unacceptable levels of contamination from the Chevron facility
- 3½ million gallons of petroleum products have been pumped from the groundwater and managed safely
- The plume of contaminated groundwater is not expanding beyond the area where it already exists
- Following a public comment period and a public hearing, the final remedy was selected in 2004 for sludges and contaminated soils
- Since the remedy for sludges and contaminated soils was selected in 2004, 337,661 tons of hazardous waste have been removed from the former refinery site and placed in secure landfills
- A land use plan for the former refinery site has been developed with significant input from community leaders
- Nearly 100 public meetings of the Community Advisory Panel have been held

## Ohio Department of Health Comments and U.S. EPA Responses

45. Comment : The accumulation of free-product and vapor-phase hydrocarbons under the village led to vapor-phase hydrocarbons making their way up from the water table to the soils immediately under residential portions of the village in 1997 (see results for VW 96 collected in 1997). This vertical migration of vapor phase hydrocarbons necessitated the installation by Chevron of the horizontal SVE system under the east edge of the village in 1999. The system's operation in 2000-2002 (and subsequent intermittent operations in 2005-2006) appears to have been somewhat successful in removing some of the vapor-phase hydrocarbons from the soils under the village and interrupting the flow of these vapors from the plume at depth to the shallow subsurface soils under the village. Contrary to Chevron's claims, we believe the operation of the SVE system has led to the apparent "gaps" in vapor phase hydrocarbons in soils under

the village evident in nested vapor wells adjacent to the SVE system, not natural biodegradation by aerobic microbes.

Response: There has been multiple sampling of soil vapors in Hooven. Different methods were employed to measure soil vapors. Vapor monitoring wells, and vapor flux measurements-both downhole and surface. Vapor monitoring wells measure the soil gas concentrations in a permanent well and the downhole vapor flux measurements are taken in a soil boring and measure the flux, or change in soil gas flow. Vapor Well (VW) VW-93 and VW-96 were installed in July and August 1997, and VW-99 was installed in November 1997. Initial sampling of VW-93 (in August '97) and VW-96 (in September '97) was conducted using only Tedlar bags and using the TO-3 method of analysis. Subsequent sampling of these vapor monitoring wells on 12/97, was conducted using summa canisters and the TO-3 method of analysis. The initial August and September 1997 did not use summa canisters and the samples also yielded results with high detection limits, leaving uncertainty as to the actual results. The December 1997 sampling shows primarily non-detect results for benzene at 15 and 35 feet below the surface. U.S. EPA review of the data from 2005 showed similar results from the pre-SVE sampling which showed vapor results near the plume and at the surface with non detect or trace amounts in between. This data leads us to conclude the SVE, while removing a lot of the mass of the plume in the vapor phase, is not the cause of the "gap" seen in soil vapor data in 2005.

46. Comment: We continue to have concerns with regard to the potential for vapor-phase hydrocarbons from the underlying plume to migrate through soils under the village of Hooven in areas above the free-product and dissolved phase portions of the plume but outside of the cone of influence of the current SVE system. Additional nested vapor wells need to be installed in these areas to determine if the plume under the village indeed poses a threat to these portions of the village outside the area of influence of the SVE system.

Response: As stated in the response to question 45, the data leads us to conclude the SVE, while removing a lot of the mass of the plume in the vapor phase, is not the cause of the "gap" seen in soil vapor data. In terms of the vertical influence SVE in Hooven is targeted toward the smear zone (50-60 ft bgs) rather than the shallow depth (20-30 ft) at which the gap is found. From a map view the radius of influence of the three SVE wells covers most of the plume footprint under Hooven. The Interim Measures and Implementation Report and the Operation and Maintenance Plan for the Hooven SVE system details the radius of influence and testing for the SVE wells installed under Hooven. The recently installed nested wells such as MW-126 and MW-127 over the dissolved plume and MW-129 and MW-130 beyond the plume supports that conclusion.

47. Comment: We feel the potential for vapor intrusion in the commercial area currently being built in the Southwest Quadrant Area needs additional investigation as well. These properties are on the floodplain of the Great Miami River immediately downgradient of the pooled accumulations of hydrocarbons and appear to be much more vulnerable to vapor intrusion than the village which is sitting atop an additional 20+ feet of soil.

Response: U.S. EPA is aware of the risk in the Southwest Quadrant. The LNAPL and dissolved groundwater plumes also lie beneath the western portion of the Southwest Quadrant. The principal potential exposure pathways to the human receptors in the Southwest Quadrant include the extraction and use of contaminated groundwater and inhalation of benzene through vapor migration of benzene to the ground surface. The performance standards in the southwest quadrant are to protect human receptors from exposure to contaminants in groundwater and to stabilize the LNAPL and groundwater plumes in this area. The proposed remedy includes engineering and land use controls addressing the potential human exposures in the Southwest Quadrant. These controls include the installation of vapor barriers in buildings in these areas, and a statutory prohibition on groundwater use on the installation of wells where known contaminants will be conducted to a well. The high grade pumping scheme is designed to remove LNAPL from beneath the Southwest Quadrant and further stabilize the LNAPL plume in this area. Monitoring of the LNAPL in the Southwest Quadrant will be accomplished using Rapid Optical Scanning Technology (ROST) wells in three or four transects. These will be located outside the smear zone and monitored semiannually for first five years, annually for next five years, staggered (to account for seasonality) biennially for next ten years, every five years thereafter. If LNAPL is detected at these ROST wells then Chevron must resume year-round pumping until compliance is restored, and re-evaluate alternate LNAPL recovery techniques subject to U.S. EPA's review and approval. The contingencies could include focused aggressive source removal (e.g. air sparging, solvent flushing etc.)

48. Comment: How you can exceed the non-cancer hazard index for benzene in this area (HI = 2) yet still be within the "acceptable level" regarding long-term cancer risks?

Response: EPA considers this unacceptable level and accordingly institutional and engineering controls have been recommended for the Southwest Quadrant area as explained above in comment # 47.

49. Comment: Are engineering and land use controls in SW Quadrant currently in force? Development is already well along in the area. From Statement of Basis for Groundwater, 2006.

Response: Yes, Engineering barriers have been offered to property owners on the Southwest Quadrant by Chevron. The selected remedy includes engineering barriers in the Southwest Quadrant. Also, as the Statement of Basis explains, groundwater use is restricted, by Ohio EPA regulations.

50. Comment: The Health Assessment Section has concerns as to whether the remedial technologies that are part of Alternative 2 will have any more impact on reducing the volume of the free-product in the groundwater under the site than the previous 20 years of pumping and treating have had. Given the current set of alternatives, we think a combination of the targeted high-rate pumping proposed in Alternative 2, coupled with Alternative 5 (using a surfactant to help facilitate removal of hydrocarbons from the smear zone and release them for capture by the pump & treat system), would likely be a more effective approach to take to try and reduce the volume of hydrocarbons still remaining in the aquifer under the village than the limited high-grade pumping approach proposed in Alternative 2.

Response: There are significant differences in the pump rate between the high

grade pumping proposed and the previous well pump rate of the pump wells on site. The high grade pump rate pump is at approximately 3,500 gal/min vs. the previous rate of 1,200 gal./min. This increased pumping rate at the wells near Hooven, as tests have shown, would help reduce the plume from under Hooven. Alternative 5 would still have the same problems as laid out in the Statement of Basis. The technology, as shown in bench top studies, may increase dissolved concentrations of contaminants thereby spreading the plumes in groundwater and requiring additional containment measures. The ability to put in a dense grid of SEAR in Hooven would not be possible, given the grid density proposed in the Groundwater Statement of Basis.

51. Comment: We would also like a more detailed description from Chevron with regard to future operation of the SVE system under the village as, in our opinion, this system, more than any remediation carried out by Chevron at this site to date, seems to have been the most effective at reducing the public threat to the residents of Hooven from the underlying contaminant plume.

Response: U.S. EPA recognizes the Hooven SVE system as an effective means to reduce the contamination source under Hooven. Continued operation of the soil vapor extraction system is a component of the proposed remedy as described in ground water statement of basis. The Final Decision and Response to Comments adds more detail to clarify the conditions under which Chevron should operate the Hooven soil vapor extraction system in the future.

52. Comment : How is it that Chevron-Texaco was allowed to submit a Human Risk Assessment re: Volatile organic compounds (VOCs) in the Vapor Intrusion pathway -- based on only one single sampling event?

Our understanding of the process from conversations with peers at Ohio EPA and past experience with other US EPA Haz-mat sites is that US EPA risk assessment protocols, at least for VOCs in groundwater and ambient and/or indoor air pathways, require a minimum of four quarters of environmental sampling data due to well-documented seasonal fluctuations in VOC levels throughout the year. Soil gas levels for VOCs surely also will reflect these seasonal fluctuations in concentrations as they are directly linked to groundwater plumes or vapors coming off of contaminated soils. The April, 2005 sampling carried out by Chevron-Texaco does not even approximate a "Worse Case Scenario" based on their own documents.

**HAS recommends carrying out additional rounds of soil vapor sampling under the village of Hooven to more completely capture potential seasonal variations in soil gas under the village**

Response: Vapor intrusion assessment is an evolving science. Following the issuance of draft vapor intrusion guidance by OSWER in Dec 2003, U.S. EPA Region 5 revisited the vapor intrusion issue in Hooven and requested Chevron to revise the risk assessment submitted in May 2000. The vapor intrusion guidance requires the facility to conduct a pathway analysis through multi tiered screening process. After it is made certain that the pathway is complete, risk assessment is required to assess the risk associated with the complete inhalation exposure pathway. It should be noted that the deep nested wells, near surface and subsurface vapor probes in the sampled locations in Hooven are permanent probes that provide the option of re-sampling when required.

The deep nested well sampling from 5 locations from the March 2005 sampling event supported the main idea that the petroleum hydrocarbon concentrations decline rapidly in the deep vadose zone which is 30 to 55 ft. below ground surface. Soil gas VOC concentrations at this depth from all the three nested vapor probes over the plume and dissolved plume did not exceed the site specific screening criteria. Further, the identification of similar compounds at trace levels near the surface (5 to 10 ft bgs) inside and outside the plume suggested the possibility of contribution of VOCs from surface activities.

The March 2005 sampling event is not the only event which provides the evidence that active degradation is extensive at the deep vadose zone. Two sample events conducted in September 2005 (at low water table/ worst case scenario) and June 2006 (samples collected and analyzed by EPA) also confirmed the active degradation of petroleum hydrocarbons in the deep vadose zone and a "clean zone" free of plume related VOCs between 20 and 30 ft bgs. Please note that EPA is keeping track of this incomplete pathway and requires Chevron to conduct semi annual sampling for the first 2 years. Efforts will be taken to conduct the sampling event during seasons likely to present a worst case scenario.

53. Comment: Based on Chevron-Texaco's own studies (Horizontal SVE System O & M and Monitoring Schedule; CEC, November, 2001), the 2005 soil gas field investigation was not carried out under a "Worse Case Scenario".

This document indicated that soil vapor production is limited under high water table conditions which are typical of the Great Miami River watershed during the spring months – including April, 2005 when the field investigation was carried out. Chevron-Texaco has stated in its documents (CEC, 2001) that the optimal time for vapor production was during low water table events when the hydrocarbon "smear zone" bracketing the fluctuating water table is exposed above the water table, allowing for vaporization of attached volatiles and migration of these chemicals as vapors up through the overlying soils towards the ground surface.

In addition, Chevron-Texaco's 2005 document indicates that a "significant rainfall event" (2.5 " rain in a two-day period at the end of March with stream flow up to 21,000 ft<sup>3</sup>/sec in the GMR) occurred in the area during the initial stages of the subsurface gas sampling under the village. The additional effect of this event on vapor levels in soils under the site due to the influx of surface waters into the underlying soils is largely unknown.

On both counts, this was not the optimal time for vapor production in soils under the site and this sampling time period certainly does not represent anything close to a worst case scenario.

The "Worst Case Scenario" would more likely be captured by carrying out soil gas investigations in the late summer and early fall, typical "drought" months in SW Ohio when the water table in the buried valley aquifer underlying the floodplain of the GMR is likely to be at its lowest (stream flows of <750 ft<sup>3</sup>/sec in the GMR and depths to water table in Ohio Observation well H-1 of -24 ft bgs compared to -21 ft bgs in April 05). According to Chevron-Texaco, vapor production should be at a maximum under these conditions at this time.



**HAS recommends that at least one of the additional soil gas sampling events captures this “Worse Case Scenario” – i.e. sampling in late summer or early fall.**

Response: Following the March 2005 sampling event, two other events have already taken place - one in September 2005 and the other in June 2006 to account for worst case scenario and seasonal variation. In all these events, VW-96 continues to show high vapor concentration near the source area. The concentration of BTEX rapidly declines with the upward migration. A “clean zone” free of VOCs is identified between 20 and 35 feet in all these sampling events confirming an incomplete pathway for inhalation exposure for the residents of Hooven.

54. Comment: Chevron-Texaco’s “Site Model” (October, 2005 Report, Figure ES-1) seems to be based on selected nested Vapor Well results (primarily those for VW 128 and VW 93) and does not seem to be as well supported by the results obtained from other nested Vapor Wells across the village (VW 127, VW 129, VW 130, VW 96, and VW 99).

Chevron-Texaco’s Site Model predicts detections of site-related hydrocarbons within 10 feet of the water table over the plume, followed by a VOC-free zone 20-30 ft below the ground surface, with higher levels of a different suite of VOCs in the upper 10-15 ft of soil under the village. These latter shallow subsurface soil gas compounds are described as consisting of chemicals not associated with the gasoline plume under the village (i.e. Chloroform, MTBE, chlorinated solvents) and resulting from non site-related activities taking place on these residential properties.

VW 127, 129, and 130 detected trace levels of site-related hydrocarbons throughout the entire vadose section of the soils under the village. VW 96 has site-related hydrocarbons at 55 ft bgs, 45 ft bgs, 40 ft bgs, 30 ft bgs, and in the upper 5 ft of soil.

VW 127 has trace detections of supposedly non site-related PCE at depths of 40 and 50 ft bgs; VW 130 has PCE at depths of 15 and 30 ft bgs; VW 96 has PCE at depths of 30-45 ft bgs; and VW 99 has PCE at depths of 20-30 ft bgs. What is the source of this PCE? How did it get where it is? Why isn’t it detected in soils above and below the soil intervals where it was found?

While it is likely that surface activities in residential properties have had some effect on soil vapor levels of some compounds in the upper 10-15 ft of soil in the area (see VW 128), the results presented are not fully conclusive as to the origins of these detected VOCs. Can US EPA or Chevron-Texaco distinguish between BTEX from the site and BTEX in soils resulting from surface activities by Hooven residents?

To my knowledge, MTBE was never used as a gasoline additive in Ohio (might have been used in adjacent portions of northern Kentucky: Louisville and Covington area). [USGS data in Carter et. Al. 2006. Journal of AWWA. 98:4:91-104]

Note: A previous site document (Chevron Cincinnati Facility Phase II Facility Wide Human Health and Ecologic Risk Assessment, E&E, April, 2000, p.2-11 and 2-16) lists both Chloroform and Tetrachloroethene (PCE) as Chemicals of Concern at the Chevron-Texaco site.

**HAS would like some answers to or clarification of some of these questions re:**



### **distribution of VOCs in soil horizons under the village.**

Response: In its earlier comment, HAS pointed out that VW-96 is the worst affected well with respect to high concentration of BTEX near the source area. The presence of gap even in the worst affected well presents the evidence for incomplete pathway under current conditions. This is further confirmed by the subsequent sampling which occurred in September 2005. In response to the request from the residents of Hooven, EPA conducted an independent sample analysis in June 2006. Both the sampling events in well VW-96 showed a gap free of BTEX between 20 and 30 ft bgs.

The chemical concentrations measured under homes and in other shallow (<10ft) samples were all very low, generally less than 100 micrograms per cubic meter (ug/m<sup>3</sup>). The volume of shallow soil gas beneath a residential property (approximately 50 ft by 150 ft by 10 ft with a 25% air-filled porosity) is about 531 m<sup>3</sup>. Therefore, the total mass of a chemical needed to create concentrations of 100 ug/m<sup>3</sup> is only 53,100 ug, which is the same as 53 milligrams, or 0.053 grams. This is less than a single drop for most compounds. This amount is readily released from various sources at the surface, such as oiled roads, leaking vehicles, septic systems, and chemical storage areas in garages or other outbuildings.

Another way for chemicals like those detected in shallow Hooven soils to find their way under homes is for them to flow out of the homes themselves. This is not unique to Hooven or to Ohio or to the country as a whole. Nearly all humans who live in homes with heating or air conditioning and use consumer products like cleaners, air fresheners, beauty products, paint, glue, new carpet and more, have small amounts of these chemicals in their homes. In April 2006, United States Geological Survey (USGS) submitted a report which can be found at [http://water.usgs.gov/nawqa/vocs/national\\_assessment/](http://water.usgs.gov/nawqa/vocs/national_assessment/). The assessment of groundwater included analyses of about 3500 water samples collected during 1985-2001 from various types of wells, representing almost 100 different aquifer studies. According to this report, VOCs were detected at trace amounts in 90 of 98 aquifer studies. Of the 42 VOCs detected in ground water samples the most detected at high frequency are chloroform, PCE, MTBE, TCE and toluene (Refer chapter 3, Fig .8, page 12 of the above referenced document). This report highlights that the detected VOCs were associated with natural or a mix of natural and anthropogenic factors that would affect their source, transport and fate in ground water. Table 4 in this chapter shows the positive association of chemicals such as PCE, TCE and chloroform with septic systems and urban lands apart from contribution through RCRA facilities.

Methyl Tertiary Butyl Ether (MTBE) is found at the surface and not a depth in the plume. Chevron had not manufactured MTBE at the refinery and the nearby Kentucky portion of the Cincinnati area had reformulated gasoline containing MTBE. Tetrachloroethene (PCE) is not detected in the groundwater samples in Hooven taken in the spring of 2005.

Note: The reference to the Chevron Cincinnati Facility Phase II Facility Wide Human Health and Ecologic Risk Assessment, E&E, April, 2000, p.2-11 and 2-16 only lists chloroform and PCE as part of the phase II analyte list not contaminants of concern.

55. Comment: In the Subsurface Field Investigation Report and elsewhere there doesn't seem to be any discussion about the presence or absence of preferred

pathways for soil vapor migration under the village of Hooven. There are also no discussions of the potential for horizontal migration of the vapor plume in the discussions of the site.

Review of the Subsurface Field Investigation Report (2005) indicated, via a series of site geologic cross-sections that the stratigraphy of the soils under the village of Hooven is anything but homogeneous. Whereas cross-section A-A' west-east across the northern end of the village (Figure 4) shows a layer of silty clay and sand of variable thickness (3-10 ft) across much of the village; cross-section B-B' west-east across the central and southern portions of the village (Figure 5), indicates numerous breaks in this silty surficial layer, with the more permeable sand and gravel beds extending right up to the ground surface (around MW-129 and between MW-101S and MW-126).

Cross-section C-C' (Figure 6), traversing the east edge of the village in a north-south line, shows homogeneous, highly permeable sand and gravel extending all the way from the LNAPL at the water table to the shallow subsurface soils under the village in the vicinity of VW-96 and VW-99. Interestingly, soil gas sampling of VW-96 in 1997 showed the presence of significant amount of site-related vapor phase hydrocarbons extending all the way from the water table to the surface.

Conversely, vapor well VW 128, when sampled in 2005, lacked detectable levels of vapor phase hydrocarbons at depths below 20 ft. According to the cross-section, this location is not underlain by the hydrocarbon LNAPL plume, so lacks a source for the hydrocarbon vapors in the deeper subsurface.

The site model implies that all vapor migration in soils under the village would be in a vertical direction such that elevated vapor phase hydrocarbons would only be expected to occur directly above the area underlain by the LNAPL and possibly the dissolved phase contaminant plume. West-east Cross-sections A-A' and B-B indicates that less permeable gravels, sands, silts, and clays overly the plume along the eastern edge of the village, possibly limiting the ability of the hydrocarbons vaporizing off of the plume to move upward through the soils under this part of the village. These cross-sections also suggest that vapors coming off of the plume might be more readily transported towards the surface by migrating first to more permeable gravels and sands just to the west of the plume and then moving vertically up all the way to the surface in this more homogeneous permeable sand and gravel unit (in vicinity of MW-101S).

**HAS recommends a more thorough review of the stratigraphy of the vadose zone soils under the site with the idea that there might be some defined preferred soil gas pathways under the village of Hooven due to the geology of these soils. This certainly appears to have been the case with VW 96. The potential for horizontal migration of vapor phase hydrocarbons should also be more fully investigated. These analyses might be useful in determining the siting of additional nested vapor wells under the village.**

Response: Thank you for your comment, U.S. EPA has reviewed the geologic cross sections and is aware of some heterogeneity in the deposits under Hooven. The geology was taken into account when looking at the vapor results. For clarification, VW-128 is over the dissolved phase plume, and the surface layer described above as "silty clay" is described in the report as silt or silt and clay with fine sand.

56. Comment: The case presented for active biological degradation of the vapor phase site-related hydrocarbons in the soil intervals immediately above the hydrocarbon smear zone associated with the gasoline plume seems weak.

Chevron-Texaco's own documents (CEC, November, 2001) indicate that induced "fresh air flow" diminishes below the upper 20 ft of soil even when the SVE system installed under the east edge of village was in operation. Oxygen levels may drop off even faster if air flow into the soils is not being induced by SVE system operation. In the vicinity of the "smear zone" bracketing the water table, vapor flow is described as "oxygen-deficient" due to methane-rich vapors generated in the smear zone and vaporizing directly off of the plume. This suggests that the decrease in oxygen levels and the increase in CO<sub>2</sub> levels with increasing depth from the ground surface could be simply the result of the depth to the contaminant plume and the chemistry of the vapors coming off of the plume just as easily as reflecting any kind of increased biological activity by bacteria degrading the hydrocarbon vapor plume in the soils immediately above the water table.

A comparison of hydrocarbon vapor concentrations collected in 1997 and 2005 from the same Vapor Wells along the edge of the free product plume boundary under the east edge of the village is instructive. VW 93 has never had any significant vapor phase hydrocarbons in the vadose zone (= upper 35 ft of soil) under the village of Hooven. It didn't have any significant detects in 1997 and had none in 2005.

In contrast, VW 96, just north of VW 93, had significant levels of site-related hydrocarbons (1,000s of ppb of toluene, ethylbenzene, and xylenes) at depths as shallow as 20 ft below the ground surface in 1997. These sample events (August & September, 1997) strongly suggest that site-related vapor phase hydrocarbons penetrated the entire soil column under the village in 1997, leading to the development of a completed exposure pathway linking residents in the village with the contaminants in underlying gasoline plume in 1997. It does not appear that natural biodegradation of the vapor phase plume was all that effective in reducing vapor phase contaminant concentrations in VW 96 in 1997.

However, the BTEX hydrocarbons in VW 96 in the 2005 sampling of this well are absent from the upper 50 ft of soil above the gasoline plume and under the village. High levels of hydrocarbons detected just above the plume (55-40 ft bgs) in both VW 93 and VW 96 (plus VW 99 as well) in 1997 are significantly reduced or totally gone in 2005. The difference appears to be the result of the installation and operation of the horizontal Soil Vapor Extraction system under the east edge of the village starting in 2000 and continuing into 2003. All of these sampled nested vapor wells are proximal to the distal ends of the SVE piping. It appears that the SVE system was installed by Chevron under the east edge of the village in 2000 as the result of vapor intrusion concerns generated by these 1997 vapor well results. When it was operating on a regular basis between 2000 and 2003, it appears the system was very effective in reducing the amount of vapor phase hydrocarbons in the vadose zone soils immediately above the plume. The system was rarely in operation in 2003 and 2004 due to abnormally wet weather and high water tables in the vicinity of the site, even into late summer and early fall months which typically are dry in SW Ohio, normally resulting in low water table levels. Evidently, the SVE system has been operated on an intermittent basis in 2005 and 2006 as weather conditions resumed a more typical seasonal pattern.

The case for significant biodegradation of vapor phase contaminations within 10-20 ft of the gasoline plume does not seem to us to be that strong. A remedial plan for soil gas that relies just on natural biodegradation of vapor phase contaminants does not seem adequate re: public health concerns of the village residents.

The 1997 soil gas sampling under the village provides some evidence that village residents may have been exposed to site-related compounds from the vapor phase of the plume via a completed pathway prior to the installation of the current SVE system under the east edge of the village in 2000.

Subsequent sampling suggests that this SVE system was effective in significantly reducing vapor phase contaminants in soil gas above the plume when it was operating between 2000 and 2003.

How does the operation of the current SVE system fit into the Remedial plan for the site or does it? Will there be a remedial plan for the soil vapor pathway or are the Company and US EPA simply writing off this pathway as being incomplete and therefore, of no public health importance?

Response: : Comparison of concentrations between 60 ft and 40 ft bgs in the deep nested well VW-96 and VW-99 over the plume at various sampling events show a significant reduction in the BTEX concentration as the vapor migrates upwards. Sampling events such as December 1998, February 1999 and June 1999 occurred before the installation of SVE system and each one of them show a significant reduction in concentration at a depth of 40 ft bgs. Reduction in BTEX concentration in association with a classic profile of decreasing oxygen and increasing carbon dioxide at the deep vadose zone is indicative of biodegradation. U.S. EPA is also aware that biodegradation at the deep vadose zone solely is not responsible for source reduction and does not dispute that Hooven residents may have been exposed to site-related compounds from the vapor phase of the plume via a completed pathway prior to the installation of the current SVE system. HAS is correct in pointing out that since the installation of SVE, the source concentration is dramatically reduced. To U.S. EPA, public health at Hooven is of utmost importance. Although the latest sampling events since the installation of SVE system confirmed the incomplete vapor intrusion pathway, U.S. EPA proposes to continue the operation of SVE system as an effective means to reduce the contamination source under Hooven. Please refer to the Groundwater Statement of Basis and the listed conditions for operation of SVE in the Groundwater remedy final decision document.

57. Comment: The results of the 2005 soil gas sampling of nested Vapor Wells, especially VW-128, VW-127, VW-93, VW-96, and VW-99 along the eastern edge of the village of Hooven, may not be representative of vapor intrusion conditions away from the SVE system installed in the immediate vicinity of these wells in 2000. The 2005 sampling results for these wells may reflect the effectiveness of this SVE system in reducing hydrocarbon vapor levels above the gasoline plume and may not be representative of conditions underlying the rest of the village.

Due to their location proximal to the distal ends of the SVE system underlying the eastern edge of Hooven, HAS has concerns that line of sampled nested Vapor Wells VW 128, 127, 93, 96, and 99 all have been impacted by past operations of the SVE system, reducing vapor levels in the intervening soil intervals above the gasoline plume.



There is no data for areas further away from the SVE system yet still within occupied portions of Hooven overlying the “dissolved plume” or the free-product plume. These areas, beyond the direct area of influence of the SVE system, might show a significantly different picture of vapor migration under the village.

Potential sites for additional nested Vapor Wells to fill in this potential gap would be in the vicinity of MW-122, MW-125, and MW-101 west of the current line of Vapor Wells and northeast of VW-99, between it and Rt. 128 (maybe near MW-121).

**HAS will be recommending the installation of additional nested Vapor Wells in the areas detailed above.**

Response: Same answer as # 46

## Chevron Comments and U.S. EPA Responses

58. Comment: Section II (p. 2), Section V (pgs 14-15), Section VI (Table 1), and Section VII (pgs 19-20, 22) refer to a final cleanup goal of achieving maximum contaminant levels (MCLs) throughout the plume within 30 years. Our interpretation of 30-years being the functional definition for “achieving the site specific remediation objectives within a timeframe that is reasonable compared to other remedial alternatives” is a reasonable starting point for defining the time to completion. However, 30-years as an absolute goal is not documented in published regulations, and does not appear to be based on technical or health based rationale. The actual time to final cleanup should be tied to the site specific circumstances and the level of risk presented by residual contamination. Based on decades of site data, remediation results, and groundwater modeling, reaching the MCL for benzene within 30 years of completion of the active remediation phase (e.g. after completion of the high-grade period) is expected to be achievable. The high-grade period is expected to last between 6 and 12 years.

Response: If there was a need to use the groundwater under Hooven and the former Chevron refinery site as a source of drinking water in the foreseeable future, then it would be reasonable to select a remedy with a cleanup timeframe that’s short enough to meet the need. However, since there is an ample amount of uncontaminated groundwater readily available nearby, there is no particular urgency to use the groundwater under Hooven or the former Chevron refinery as a drinking water source in the foreseeable future. Thus, we must determine whether the length of the cleanup time frame is reasonable by comparing the proposed alternative (#2) with the other alternatives that are available (#3, 4 and 5). We also need to make sure that the proposed remedy will be implemented expeditiously as can be reasonably expected.

We’ve compared the alternatives, and Alternative 2 is still the best overall. Controlling the source of the groundwater contamination is the most effective way to ensure that monitored natural attenuation will be as successful as can be expected. Chevron has removed the leaky tanks, pipes and ponds that were the original sources of the groundwater contamination. Chevron has also taken steps to make sure that sludges and contaminated soils are not an ongoing source of groundwater contamination. In many other U.S. EPA cleanup projects, we only need source control measures similar to these to assure a timely cleanup using monitored natural attenuation.

However, the situation here is complicated by the fact that the petroleum products that originally leaked out of the tanks and pipes have formed an LNAPL layer and a smear zone, which are now serving as the current sources of the contamination. Considering these complications, the overall time frame for cleaning up the Chevron groundwater contamination will be longer than the remediation time frame for many of the other projects that the U.S. EPA is handling. Considering the fact that there are no ongoing unacceptable human health exposures nor any urgent need to use the groundwater in Hooven as a source of drinking water, as well as these complications, the overall time frame of 36 to 42 years is reasonable in this situation.

Benzene is the most widespread contaminant, and it exceeds the MCL by the greatest factor; thus it is the primary contaminant that will be used to track the cleanup of the plume. The goal for this timeframe is based on the projected attenuation pattern for benzene which involves biodegradation. Other organic contaminants, such as ethylbenzene, and 1,2-dichlorobenzene will also follow an attenuation pattern involving biodegradation. The dissolved ethylbenzene concentrations are expected to meet the current MCL in 90% of the wells at the site within 25 to 30 years after the completion of the high-grade pumping for source control. In other words, the concentration of ethylbenzene is expected to meet the MCL a little sooner than benzene. The concentration of 1,2-dichlorobenzene is expected to meet the MCL a little later than benzene. Inorganic contaminants, such as lead and arsenic, will probably follow a different attenuation pattern because they do not biodegrade. Further improvement is expected to occur very slowly. Nevertheless, at the end of the 36 to 42-year time period, the concentrations of the inorganic constituents are expected to be below the current levels, and the current levels are just above the MCLs.

After the 36-to 42-year time frame, the groundwater will still have taste and odor problems, and will still have unacceptable concentrations of other non-volatile chemicals. These conditions will exist for a long time. Thus, the use of the groundwater will remain restricted and natural attenuation will continue until the groundwater quality is fully restored.

59. Comment: Section III (pgs 4 and 6) indicates that the hydrocarbon smear zone is located at a depth between 10 to 30 feet below ground surface (bgs). The smear zone observed beneath the facility, Hooven, and the commercial properties located to the southwest of the facility (Southwest Quadrant) is variable depending on surface elevation, depth to water and the thickness of the smear zone, and is generally deeper than 10 to 30 feet bgs. For example the depth to the top of the smear zone beneath Hooven is approximately 30-60 feet bgs and depth to the bottom of the smear zone is approximately 50-75 feet bgs.

Response: EPA notes your comment, depending on where you are on and off the site, the distance to the smear zone varies. EPA did not mean to apply only one set distance from ground surface to smear zone.

60. Comment: Section IV (A) (p. 9) indicates that “the human health screening values used were the U.S. EPA Region 9 Preliminary Remediation Goals (PRGs).” The



Region 9 PRGs were not used for screening soil vapor sample results collected in Hooven during investigation activities completed in 2005. The soil vapor screening levels for the Subsurface Investigation and Field Services Report and Human Health Risk Assessment, Chevron Cincinnati Facility, Hooven, Ohio (Trihydro 2005) were obtained from the U.S. EPA Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils, published in 2002.

Response: EPA agrees with this comment.

61.Comment: Section IV (B)(1) (pgs 9-10) describes the contaminants of potential concern (COPCs) to groundwater, and differentiates them by three areas: Facility property, Hooven, and Southwest Quadrant. The final list of COPCs should be based on a review of historical trends and current knowledge regarding individual constituent chemical and physical characteristics. The COPCs for the Facility property, Hooven, and the Southwest Quadrant should be a single list that reflects contaminants associated with the LNAPL; both those that can dissolve from the LNAPL and those that can result from chemical reactions/weathering of the LNAPL (i.e. daughter products, metals, inorganics). Two of the COPCs (isopropylbenzene and total xylenes) have not been reported above remedial standards in groundwater samples collected since 1998, and three other COPCs have only a single detection (acetone, toluene, pyrene) above remedial standards since 1998. These should be removed from the list of COPCs.

Response: U.S. EPA has determined that these COPCs should remain on the list. The COPC for Hooven are listed in the Human Health Risk Assessment for Hooven, 2000. COPCs for the refinery property are listed in the Human Health and Ecological Risk Assessment of 2000. The COPCs for the Southwest quadrant are listed in the Southwest Quadrant Risk Assessment 2002.

62.Comment: Section IV (B)(2) (p.10) refers to "groundwater vapor" and identifies Vapor COPCs. This section would be more accurately titled "Soil Vapor COPCs", as soil gas samples and flux chamber samples were used to evaluate the potential for inhalation of volatiles in indoor and outdoor air pathways. The discussion could be further clarified by explaining that constituents of potential concern in soil vapor can derive from multiple sources at the surface and in the subsurface, and the long-term monitoring program is to monitor the potential contribution of COPCs to soil vapor from the LNAPL and dissolved phase plumes associated with the Chevron facility. The term "soil vapor" should be used, rather than "groundwater vapor".

Response: Duly noted

63.Comment: The vapor migration pathway from LNAPL or dissolved plume to indoor air in the residents of Hooven was determined to be incomplete (see p. 12 of the Statement of Basis), so there are no COPCs for vapor intrusion in Hooven. Therefore, the COPC list should be removed. Chevron will work with U.S. EPA to develop an analyte list that will be monitored during the final remedy to confirm the pathway for vapor migration into residences remains incomplete.

Response: Contaminants of Potential Concern remain the same whether the pathway is complete or incomplete. The pathway remains while the potential still exists.

64.Comment: Section IV (C)(1b) Future Construction/Remediation Worker (p. 11) indicates the RME is 0.032. The hazard index (HI) for the reasonable maximum exposure (RME) should be 0.32.

Response: U.S. EPA agrees the RME should be 0.32.

65.Comment: Section IV (C)(2a) Future Industrial/Commercial Worker (p. 11) indicates the RME is 0.035, and that the hazard indices discussed are for inhalation of vapors in a basement. The HI for the RME should be 0.35. The hazard indices discussed in this section are for outdoor inhalation of vapors. Section IV (C)(2a)(i) discusses the basement scenario hazard indices.

Response: EPA agrees with the comment.

66.Comment: Section IV (C)(4a) Future Adolescent Recreator (p. 11) states that “a subgroup of SVOCs, the polynuclear aromatic hydrocarbons (PAHs), was the major source of carcinogenic risk in the Recreational Reuse Area.” PAHs were a driver for soil exposure but not for inhalation.

Response: EPA agrees with the comment.

67.Comment: Section VII Scope of Proposed Remedy – Alternative 2 (p. 21) indicates that Chevron shall sample any new wells installed along the point of compliance (POC) boundary quarterly for two-years. These wells are not expected to contain any dissolved phase constituents. In keeping with the sample size for valid statistical analyses recommended by the U.S. EPA in the Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (February 1989, U.S. EPA, Office of Solid Waste, Waste Management Division), of four independent sampling events, Chevron proposes that any new wells installed along the POC boundary will be sampled semiannually during the first two years following installation, and that the sampling frequency would then revert to that followed for the rest of the wells being monitored.

Response: U.S. EPA is concerned about dissolved phase plume migration and that any initial migration be found by groundwater well monitoring. As, per the Statement of Basis, when the pumping wells are phased out, quarterly sampling is necessary to assess the dissolved phase plume boundary.

## **Ohio Environmental Protection Agency (OEPA) Comment and U.S. EPA's Response**

68. Comment: One of the stated performance standards for the proposed remedy's impact to the Great Miami River directs Chevron Corporation to ensure

“the prevention of any discharge of dissolved constituents to the river above appropriate Ohio EPA surface water standards.”

An additional stipulation within this section states:

“If OEPA surface water standards are exceeded or sheens appear on the Great Miami River, then the contingency is to resume year-round groundwater pumping until compliance with the standard is restored.”

Furthermore, a final stipulation citing Ohio EPA surface water standards within this section states:

“In addition, Chevron will evaluate contingency alternatives, including perimeter treatment system (e.g., sparge curtain, funnel/gate, etc.), aggressive source

removal (e.g., air sparging, SVE, solvent flushing (SEAR) etc.), and implement additional corrective measures if necessary to meet the performance standard of allowing no migration of LNAPL or dissolved constituents into the river above OEPA surface water standards.”

Chapter 6111 within the Ohio Revised Code (ORC) is the authority utilized by our agency's Division of Surface Water to regulate all discharges to waters of The State of Ohio. The following prohibition is noted:

*6111.04. Acts of pollution prohibited; exceptions.*

*(A) Both of the following apply except as otherwise provided in division (A) or (F) of this section:*

*(1) No person shall cause pollution or place or cause to be placed any sewage, sludge, sludge materials, industrial waste, or other wastes in a location where they cause pollution of any waters of the state.*

*(2) Such an action prohibited under division (A)(1) of this section is hereby declared to be a public nuisance.*

*Divisions (A)(1) and (2) of this section do not apply if the person causing pollution or placing or causing to be placed wastes in a location in which they cause pollution of any waters of the state holds a valid, unexpired permit, or renewal of a permit, governing the causing or placement as provided in sections 6111.01 to 6111.08 of the Revised Code or if the person's application for renewal of such a permit is pending.*

Therefore, in accordance with applicable Ohio Law, U.S. EPA should revise the Statement of Basis to prohibit Chevron Corporation from conducting any un-permitted discharges containing contaminants to waters of the state.

Response: We agree with the OEPA interpretation of their surface water regulation to prohibit un-permitted discharges containing contaminants to the Great Miami River.

## Future Actions

U.S. EPA and Chevron are negotiating an Administrative Order on Consent to implement the selected remedy. Oversight by U.S. EPA will be conducted to insure adherence to the modifications to the remedy based on the public's comments. In the event that Chevron would decide not to implement the selected remedy, U.S. EPA may use its enforcement authorities to order Chevron to implement the selected remedy.

## Declaration

Based upon the Administrative Record compiled for this corrective action, U.S. EPA has determined that the selected remedy is appropriate and is protective of human health and the environment.

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Margaret Guerriero  
Director, Waste, Pesticides and Toxics Division  
U.S. EPA, Region 5

Date

**ATTACHMENT I**

**STATEMENT OF BASIS  
FOR  
SELECTION OF REMEDIAL ALTERNATIVE  
FOR GROUNDWATER  
AT**

CHEVRON  
Near HOOVEN, OHIO

APRIL, 2006

OHD 004 254 132



**ATTACHMENT II**

ADMINISTRATIVE RECORD INDEX  
CHEVRON/TEXACO  
HOOVEN, OHIO  
OHD 004 254 132

**ADMINISTRATIVE RECORD INDEX  
CHEVRON/TEXACO  
HOOVEN, OHIO  
OHD 004 254 132**

	<b>Date:</b>	<b>To:</b>	<b>From:</b>	<b>Format:</b>	<b>Subject:</b>
1	July 17, 2006	Bri Bill, US EPA	Robert C. Frey, ODH	Letter	ODH comments to the EPA preferred Plan for the Contaminated Groundwater at Chevron Cincinnati facility
2	June 27, 2006	Bri Bill	Steve Chabot, Member of Congress	Letter	Letter recognizing Alysha Johnson's Letter concerning Chevron's Clean-up and handing matters over to US. EPA -attachment: Alysha Johnson's Letter
3	June 27, 2006	Benny Muncy	Bharat Mathur	Letter	Control reply concerning Chevron clean-up
4	June 27, 2006	Virginia Pappin	Bharat Mathur	Letter	Control reply concerning Chevron clean-up
5	June 27, 2006	Mr. & Mrs. John Wheeler	Bharat Mathur	Letter	Control reply concerning Chevron clean-up
6	June 26, 2006	Bri Bill	Steve Chabot, Member of Congress	Letter	Letter recognizing Kelly Greer's Email concerning Chevron's Clean-up and handing matters over to US. EPA -attachment: Kelly Greer's Email
7	June 19, 2006	Bri Bill	Steve Chabot, Member of Congress	Letter	Letter recognizing Elaine Reeves' letter concerning Chevron's Clean-up and handing matters over to US. EPA -attachment: Elaine Reeves' Letter
8	June 19, 2006	Bri Bill	Steve Chabot, Member of Congress	Letter	Letter recognizing Rodney Wheeler, Jr. & Rodney Wheeler, Sr.'s Letter concerning Chevron's Clean-up and handing matters over to US. EPA -attachment: Rodney Wheeler, Jr. & Rodney Wheeler, Sr.'s Letter
9	June 19, 2006	Bri Bill	Steve Chabot, Member of Congress	Letter	Letter recognizing the Detmer Family Letters concerning Chevron's Clean-up and handing matters over to US. EPA -attachment: Detmer Family Letters
10	June 16, 2006	Bri Bill	Steve Chabot, Member of Congress	Letter	Letter recognizing Melissa J. Breeding's Letter concerning Chevron's Clean-up and handing matters over to US. EPA -attachment: Melissa J. Breeding's Letter
11	June 16, 2006	Bri Bill	Steve Chabot, Member of	Letter	Letter recognizing Theodore Moses' Letter concerning Chevron's Clean-up and handing

			Congress		matters over to US. EPA -attachment: Theodore Moses' Letter
12	June 16, 2006	Bri Bill	Steve Chabot, Member of Congress	Letter	Letter recognizing Britni Smith's Email concerning Chevron's Clean-up and handing matters over to US. EPA -attachment: Britni Smith's Email
13	June 16, 2006	Bri Bill	Steve Chabot, Member of Congress	Letter	Letter recognizing Crissy A. Moses' Letter concerning Chevron's Clean-up and handing matters over to US. EPA -attachment: Crissy A. Moses' Letter
14	June 16, 2006	Bri Bill	Steve Chabot, Member of Congress	Letter	Letter recognizing Donna M. Moses' Letter concerning Chevron's Clean-up and handing matters over to US. EPA -attachment: Donna M. Moses' Letter
15	June 16, 2006	Bri Bill	Steve Chabot, Member of Congress	Letter	Letter recognizing Vince Pappin's Letter concerning Chevron's Clean-up and handing matters over to US. EPA -attachment: Vince Pappin's Letter
16	June 14, 2006	Chevron and US EPA	Deidre Lewis	Letter	Concerns regarding Chevron's proposed cleanup/final remedy
17	June 14, 2006	Christopher Black, US EPA	Alysha Johnson	Email	Comments to Statement of Basis for Groundwater
18	June 14, 2006	Bri Bill, US EPA	Marsha Kay Klosterman	Email	Hooven Chevron Clean-up
19	June 14, 2006	Christopher Black, US EPA	Bri Bill, US EPA	Email	FWD: Hooven Chevron Clean-up
20	June 14, 2006	Christopher Black, US EPA	Deidre Lewis	Email	Hooven Chevron Clean-up/Final Remedy
21	June 13, 2006	Christopher Black, US EPA	Whitewater Township Residents	Letter	Petition concerning Chevron cleanup/final remedy method
22	June 13, 2006	Christopher Black, US EPA	Kelly Greer	Email	Hooven Chevron Clean-up/Final Remedy
23	June 13, 2006	Christopher Black, US EPA	Britni Smith	Email	Hooven Chevron Clean-up/Final Remedy
24	June 13,	Christopher	William Balsley	Email	Hooven Chevron Clean-up/Final Remedy

	2006	Black, US EPA	Jr.		
25	June 5, 2006	Steven L. Johnson, US EPA	Steve Chabot, Member of Congress	Letter	Letter recognizing Virginia Pappin's letter concerning Chevron's Clean-up and handing matters over to US. EPA - attachments: Virginia Pappin's, Benny Muncy, and Mabel & John J. Wheelers letters
26	May 30, 2006	Christopher Black, US EPA	Randy W. Jewett, Chevron	Letter	RE: U.S. EPA Statement of Basis for Groundwater, Chevron Cincinnati Facility, Hooven, Ohio, U.S.
27	May 30, 2006	Bri Bill, US EPA	JK Services	Fax	Questions/Comments on Chevron
28	May 25, 2006	Christopher Black, US EPA	John Breeding & Melissa M. Breeding	Letter	IN RE: Chevron Contamination Hooven/Cleves Refinery
29	May 25, 2006	Christopher Black, US EPA	Melissa J. Breeding	Letter	IN RE: Chevron Contamination Hooven/Cleves Refinery
30	May 24, 2006	Christopher Black, US EPA	Larry Detmer	Letter	IN RE: Chevron Contamination Hooven/Cleves Refinery
31	May 24, 2006	Christopher Black, US EPA	Olivia Detmer	Letter	IN RE: Chevron Contamination Hooven/Cleves Refinery
32	May 24, 2006	Christopher Black, US EPA	Amy Detmer	Letter	IN RE: Chevron Contamination Hooven/Cleves Refinery
33	May 22, 2006	Christopher Black, US EPA	Rodney Wheeler Sr. & Rodney Wheeler Jr.	Letter	IN RE: Chevron Contamination Hooven/Cleves Refinery
34	May 22, 2006	Christopher Black, US EPA	Theodore E. Moses Jr.	Letter	IN RE: Chevron Contamination Hooven/Cleves Refinery
35	May 22, 2006	Christopher Black, US EPA	Vince Pappin	Letter	IN RE: Chevron Contamination US EPA Proposed Consent Agreement Hooven/ Cleves Refinery
36	May 22, 2006	Christopher Black, US EPA	Virginia Pappin	Letter	IN RE: Chevron Contamination US EPA Proposed Consent Agreement Hooven/ Cleves Refinery

37	May 22, 2006	Christopher Black, US EPA	Mabel & John Wheeler	Letter	IN RE: Chevron Contamination Hooven/Cleves Refinery
38	May 22, 2006	Christopher Black, US EPA	Donna M. Moses	Letter	IN RE: Chevron Contamination Hooven/Cleves Refinery
39	May 19, 2006	Bri Bill, US EPA	Jeff G. Hines, OEPA	Letter	RE: Chevron Statement of Basis
40	May 19, 2006	Christopher Black, US EPA	Crissy A. Moses	Letter	IN RE: Chevron Contamination Hooven/Cleves Refinery
41	May 15, 2006	Christopher Black, US EPA	Benny Muncy	Letter	IN RE: Chevron Contamination Hooven/Cleves Refinery
42	May 9, 2006	Chevron	USEPA		Proposed Plan for Contaminated Groundwater – Transcript of Proceeding
43	March 16, 2006	Christopher Black, USEPA	Rittle Keith, Tri-Hydro	Email	RE: Chevron GW Mtg. Date – email submitting cost estimates of the alternative remedies (With Attachments – no hard copy)
44	February 16, 2006	Christopher Black, USEPA	Paul Michalski, Tri-Hydro	Email	Progress Update, Extended Non-Pumping Aquifer Evaluation (With Attachments)
45	January 25, 2006		Chevron Environmental Management Company		Plug and Abandonment Notification, Groundwater Production Wells PROD_8, PROD_9, PROD_16, PROD_17, PROD_18
46	January 25, 2006	Christopher Black, USEPA	Paul Michalski, Tri-Hydro	Email	Review of Preliminary Non-Pumping Aquifer Evaluation Results (With Attachments)
47	January 20, 2006	Christopher Black, USEPA	Rittle Keith, Tri-Hydro	Email	Shut-Down Test Data (With Attachments –NEED HARD COPY)
48	January 16, 2006	Christopher Black, USEPA	Rittle Keith, Tri-Hydro	Email	Extended Non-Pumping Aquifer Evaluation (With Attachments)
49	2006		U.S Department of Interior & USGS		Volatile Organic Compounds in the Nation’s Ground Water and Drinking-Water Supply Wells (National Water-Quality Assessment Program – Circular 1292)
50	December 9, 2005	Christopher Black, USEPA	Paul Michalski, Tri-Hydro	Email	Progress Update, Extended Non-Pumping Aquifer Evaluation (With Attachments)*
51	November	Christopher	Rittle Keith,	Email	Cincinnati High-Grade Pump-Test Status



	17, 2005	Black, USEPA	Tri-Hydro		
52	October 21, 2005		US EPA		Comments Regarding Subsurface Investigation Field Activities Report & Human Health Risk Assessment
53	October 18, 2005		Trihydro		Subsurface Investigation & Field Activities Report & Human Health Risk Assessment for Chevron Cincinnati Facility, Hooven, Ohio
54	October, 2005	Bri Bill, US EPA	Bob Frey, ODH	Email	Additional HAS concerns & questions -attachment: Health Assessment Review
55	September 19, 2005	Christopher Black, USEPA	Rittle Keith, Tri-Hydro	Email	Hooven Chromatograms Analysis
56	September 14, 2005	Technical Meeting	Aqui-Ver, Inc.	Power- Point	Chevron Cincinnati Facility, Remedy Performance Measures (from CMS/Remedy Report Update), conceptual thoughts
57	September 1, 2005		Chevron Environmental Management Company		Work Plan for Extended Non-Pumping Aquifer Evaluation, Additional Assessment Activities to Support Groundwater Remedy
58	August 23, 2005		Chevron Environmental Management Company		Work Plan for Long-Term High-Grade LNAPL Recovery Test, Additional Assessment Activities to Support Groundwater Remedy
59	August 10, 2005		Chevron Environmental Management Company		Work Plan for Additional Assessment Activities Along the East Bank of the Great Miami River
60	July 29, 2005		Chevron Environmental Management Company		Second Progress Update, Additional Assessment Activities to Support Groundwater Remedy
61	June 30, 2005		Chevron Environmental Management Company		Subsurface Investigation Field Activities and the Human Health Risk Assessment (Hard Copy Needed)
62	June 30, 2005		Chevron Cincinnati Groundwater Task Force		Update to Site Conceptual Model and Summary of Remedial Decision Basis Chevron Cincinnati Facility
63	June 15,		Chevron		Third Letter Work plan for Additional Assessment

	2005		Environmental Management Company		Activities to Support the Groundwater Remedy
64	June 3, 2005	Christopher Black, USEPA	Paul Michalski, Tri-Hydro	Email	High Grade Pump Test/48-Hour Shut Down Event Wrap Up (With Attachments)*
65	May 31, 2005	Christopher Black, USEPA	Paul Michalski, Tri-Hydro	Email	5/26/05 High Grade Pump Test/48-Hour Shut Down Event (With Attachments)*
66	May 26, 2005	Christopher Black, USEPA	Paul Michalski, Tri-Hydro	Email	5/26/05 High Grade Pump Test Update (With Attachments)
67	May 26, 2005	Paul Michalski, Tri-Hydro & Gary Beckett, Aquiver, Inc.	Christopher Black, USEPA	Email	RE: Cincinnati Pump Test Update*
68	May 26, 2005	Paul Michalski, Tri-Hydro & Christopher Black, USEPA	Gary Beckett, Aquiver, Inc.	Email	RE: Cincinnati Pump Test Update *
69	May 24, 2005	Christopher Black, USEPA	Paul Michalski, Tri-Hydro	Email	RE: Cincinnati Pump Test Update (With Attachments)*
70	May 20, 2005	Christopher Black, USEPA	Rittle Keith, Tri-Hydro	Email	RE: Cincinnati Groundwater Update (With Attachments)*
71	May 18, 2005	Christopher Black, USEPA	Rittle Keith, Tri-Hydro	Email	Update Regarding Great Miami River Observations (With Attachments)*
72	May 16, 2005	Christopher Black, USEPA	Rittle Keith, Tri-Hydro	Email	Chevron Cincinnati Facility Status Report *
73	May 13, 2005	Christopher Black, USEPA	Paul Michalski, Tri-Hydro	Email	Non-Pumping Aquifer Evaluation Update, Chevron Cincinnati Facility (With Attachments) *
74	May 11, 2005	Christopher Black, USEPA	Paul Michalski, Tri-Hydro	Email	5/11 Cincinnati Groundwater Remedy Meeting *

75	April 19, 2005		Chevron Environmental Management Company		Response to USEPA Comments Regarding the March 15, 2005 Letter Workplan for Additional Assessment Activities to Support the Groundwater Remedy
76	April 1, 2005		USEPA		Comments Regarding the March 15, 2005 Letter Workplan for Additional Assessment Activities to Support the Groundwater Remedy
77	March 31, 2005		Chevron Environmental Management Company		Response to USEPA Comments dated March 18, 2005, Hooven Vapor Investigation Sampling and Analysis Workplan
78	March 25, 2005		Chevron Environmental Management Company		Revisions to the Conceptual Framework for a Groundwater Remedy Performance Based Order
79	March 18, 2005		USEPA		Comments Regarding the Hooven Vapor Investigation Sampling and Analysis Workplan
80	March 15, 2005		Chevron Environmental Management Company		Second Letter Workplan for Additional Assessment Activities to Support the Groundwater Remedy
81	March 3, 2005		Try-Hydro Corporation and GeoSyntec Consultants		Hooven Vapor Investigation Sampling and Analysis Workplan
82	March 1, 2005	March 5, 2005 Technical Meeting	Aqui-Ver, Inc.	Power-Point	Groundwater Conceptual Model Updates
83	February 18, 2005		Chevron Environmental Management Company		Progress Update, Additional Assessment Activities to Support Groundwater Remedy
84	February 10, 2005		Chevron Environmental Management Company		Conceptual Framework for Groundwater Remedy Performance Based Order
85	January 10, 2005		Environmental Resources		Cincinnati Facility Deer Ingestion Pathway: Risk Analysis

			Management		
86	January 5, 2005		Chevron Environmental Management Company		December 15, 2004 Meeting Summary Regarding the Groundwater Remedy for the Chevron Cincinnati Facility
87	December 9, 2004		Chevron Environmental Management Company		Response to USEPA Comment dated July 13, 2004, Conceptual Groundwater Remedy Report Draft Version 0
88	December 8, 2004		Chevron Environmental Management Company		First Workplan for Additional Assessment to Support Groundwater Remedy Report
89	November 23, 2004	Presented at November 18, 2004 Technical Meeting	Aqui-Ver, Inc.	Power-Point	Cincinnati Groundwater Remedy Field Investigation Workplan (Data Gap Workscop)
90	October 25, 2004		Chevron Environmental Management Company		Summary and Follow-up from October 19, 2004 Meeting Regarding the Groundwater Remedy
91	October 19, 2004	Presented at October 19, 2004 Technical Meeting	Aqui-Ver, Inc.	Power-Point	The Conceptual Final Remedy
92	October 19, 2004	Presented at October 19, 2004 Technical Meeting	Aqui-Ver, Inc.	Power-Point	Groundwater Conceptual Remedy Discussion, Cincinnati EPA Meeting (Two Sets)
93	August 17, 2004		Chevron Environmental Management Company	Letter	Letter Transmitting GAC Influent/Effluent Data
94	July 16, 2004		Try-Hydro	File	Risk Assessment – Hooven Sewer Line Investigation
95	July 13, 2004		USEPA		Comments on the “Chevron Cincinnati Facility Conceptual Groundwater Remedy Report Draft –

					Revision 0
96	January 7, 2004		USEPA		Comments Regarding the Risk Assessment on Hooven and Southwest Quadrant
97	July, 2003		Chevron Cincinnati Groundwater Task Force		Conceptual Groundwater Remedy Report for the Chevron Cincinnati Facility
98	June, 2003		USEPA		Statement of Basis for Sludge's and Contaminated Soils for Chevron/Texaco Cincinnati Facility
99	November, 2002	File	USEPA		OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)
100	May, 2002		Ecology & Environment, Inc. (E&E)		Chevron Cincinnati Facility, Human Health Risk Assessment for Potential Offsite Volatiles Exposure at the Southwest Quadrant. Revision 1.
101	December, 2001		Environmental Science & Engineering, Inc.		RCRA Facility Investigation Report for the Chevron Cincinnati Facility. Revision 2.
102	October, 2001		URS		Chevron Cincinnati Facility Groundwater Corrective Measures Study
103	September, 2001		URS		Chevron Cincinnati Facility Soils and Sludge's Corrective Measures Study
104	March 30, 2001		Chevron	File	Operation and Maintenance Plan – Hooven Horizontal Soil Vapor Extraction System
105	March 30, 2001		Chevron	File	Interim Measures and Implementation Report
106	November, 2000		E & E		Chevron Cincinnati Facility, Phase II Facility Investigation Report for the Chevron Cincinnati Facility. Revision2.
107	May, 2000		E & E		Human Health Risk Assessment of Potential Exposure to Volatile Compounds Hooven, Ohio. Revision 2.
108	October 5, 1999		Civil & Environmental Consultants, Inc.		Hooven Water Use Survey: Report of Findings
109	September 20, 1999	Ken Bardo, USEPA	John Tiffany, Chevron	Letter	Responses to Approval with Modifications dated August 20, 1999
110	August, 1999	Chevron	Environmental Science & Engineering, Inc.		A Summary of the Hooven Area Environmental Investigations Performed by Chevron Products Company



111	August 20, 1999	John Tiffany, Chevron	Ken Bardo, USEPA	Letter	RE: Approval with Modifications of Remedial Action Plan of the Hooven Area Hydrocarbon Plume, Chevron U.S.A., Inc.
112	June 3, 1999	Chevron Products Company	Environmental Resources Management		Remedial Action Plan – Hooven Area Hydrocarbon Plum
113	April, 1999		USEPA		Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites
114	* no date provided	Christopher Black, US EPA	Olivia Detmer	Letter	Concerns regarding Chevron's proposed cleanup /final remedy

**APPENDIX 1**

Region 5 Framework for Monitored Natural Attenuation Decisions for  
Ground Water

